

JAN 19 1926

Medical Lib.

THE JOURNAL OF RADIOLOGY

Vol. VI

DECEMBER, 1925

No. 12

PUBLISHED MONTHLY
AT OMAHA, NEBRASKA

OFFICIAL PUBLICATION THE AMERICAN COLLEGE OF RADIOLOGY AND PHYSIOTHERAPY

9

V

D

va
fol
ere
En
tio
pre
in
qu
act
pre
tin
hea
of
van
sie
wh
the
the
den
sea
as
of
in
pre
ica
into
are
the
evic
stru
and
gen
trea
any

T
sica

The JOURNAL OF RADIOLOGY

Omaha, Nebraska

Vol. VI.

DECEMBER, 1925

No. 12

Clinical and Electrical Aspects of Endothermy In Dermatology*

GEORGE C. ANDREWS, M. D.
New York.

DURING the past few years, endothermy, also called surgical diathermy, has invaded dermatology. It has developed manifold uses, and numerous ill-defined terms have crept into parlance to describe its effects. Endothermy is a bloodless method of destruction, caused in major part by the localized production of heat in the tissues from within, in response to the oscillations of a high frequency current. Medical diathermy is characterized by the stimulating action of heat so produced, whereas surgical diathermy is distinguished by the destructive action of such heat. In accordance with the type and power of current, and the method of application, a variety of tissue effects are manifest. Dessication may be described as a heat effect, which is sufficient to produce dehydration of the tissue, occurring slowly enough to permit the tissue fluids to evaporate. There are evident no frank chemical reactions, such as searing or charring. Fulguration is the same as dessication, together with a slight amount of coagulation. That is, there are changes in the molecular grouping, analogous to those present in a boiled egg, but no gases or chemicals are produced. Coagulation is a still more intense and rapid process, and the tissue fluids are no longer able to evaporate as rapidly as they are expressed, and they are notably in evidence. As the heat action increases, destructive chemical changes occur in the tissues, and this is called carbonization. Searing is a general term applied to the edges of tissues treated with cutting currents, and comprehends any of the preceding degrees of destruction.

TYPES OF CURRENTS AND MACHINES

The Oudin current is mainly used for dessication and fulguration. It is a current of

relatively low milliamperage and high voltage, in which the return flow of current from the patient to the machine is probably through electromagnetic waves, so that the terms, mono and uni-polar, which have been applied to it, are in a sense misleading. With Ohm's law in mind, that the current equals the voltage divided by the resistance, it is evident that the resistance plays such an enormous part in the destructive effects that the specifications of the voltage and milliamperage are valueless for indicating the dosage of this current. The length and diameter of the cable and electrode change the clinical effects enormously.

The d'Arsonval current, frequently called the bipolar method, is used mostly for coagulation and is of high milliamperage and relatively low voltage. Without specification of the size of the electrode, voltage and milliamperage are of no real value in estimating the dosage. The d'Arsonval current is the current of both medical and surgical diathermy. It is similar to a Tesla coil, except that there are relatively very few secondary windings.

The successful development of high frequency current in surgery has been made possible only through advances in the manufacture of generators to give a current of suitable oscillations. Oscillations have a tendency to decrease and die out, due to the resistance present in all conductors. To produce continuous oscillations, it is necessary to supply energy to maintain the vibrations.

In some machines used for cutting, continuous undamped oscillations are obtained by the introduction of a radio bulb which produces strictly undamped oscillations. Other machines approximate continuous undamped oscillations by a proper balance of the inductance coils and the capacity of the condenser,

*Received for publication October 8, 1925.

In the radio bulb apparatus employed for producing undamped oscillations, there is a transformer for adjusting the voltage of the incoming current, a spark gap, an oscillation vacuum tube and condensers and inductances connected with this tube. The principle of action of the oscillation tube is amplification of the current applied to the grid. The small current applied to the grid is reproduced in the circuit containing the filament and the plate from which it passes through the primary of the high frequency transformer, which has no iron core. The magnetic flux is developed in the inductance, acts upon the bariocoupler, which is located at the end of the primary inductance, and produces oscillations in accordance with a natural frequency corresponding to the size of the condenser and inductance of the bariocoupler. There is thus imparted to the grid a small oscillating current, which gives an oscillating voltage to the grid, and this voltage stirs the heavier discharge between the filament and the plate. The frequency of the oscillating circuit is, therefore, controlled to a large extent by the frequency of the grid circuit, and the latter functions as a starting mechanism for the oscillations in the circuit between the filament and the plate which, however, has its own natural frequency. Therefore, in order to obtain the maximum output, the frequencies of this current and of the grid current must oscillate at exactly the same rate. It is very necessary that the two oscillating circuits are synchronous. A small Neon lamp is used to indicate that the two circuits are in tune. With this lamp in circuit, by varying the bariocoupler, a point will be found where it glows brightest, and this indicates resonance between the two circuits. When it is so adjusted, the apparatus is ready for use. Because of possible danger of shock, which exists when the patient's circuit is directly connected to a system containing large capacities, the patient's circuit is indirectly connected to the main oscillating circuit through a magnetic coupling.

In the cutting machines built without radio bulbs the line current is passed through a step up transformer, in the secondary circuit of which is a spark gap and a condenser. As the condenser is charged and discharged, magnetic lines of force are built up and die out along this circuit, and by inductance produce in a distinct circuit oscillations of high frequency, which are sustained by a control de-

vice, so that they are practically undamped. Safety is assured by the fact that this circuit, which goes to the patient, is connected with no other part of the apparatus except by inductance. For cutting purposes, one million or more undamped oscillations per second are used. In these machines the coagulating current is the same as the cutting current; that is, while cutting if a hemorrhage is encountered, the cutting needle is applied to the bleeding point, and if the current when in use does not immediately stop the bleeding, the coagulating effect is increased by regulation of the thermocoupler, which controls the heat of the cutting current. Thus the coagulating is produced through the same circuit which is used for cutting.

In the radio tube type of machine, the undamped oscillations, while coagulating to a slight degree, have the distinct property of cutting through tissue. In the event that large blood vessels are encountered during the operation, the damped oscillations of the coagulating current are used to stop the bleeding.

With both types of instruments, the cut is clean, without sawing, and is sterile. There is also some coagulation of the blood upon the cut edges, so that the small capillaries are sealed while the cut is being made. It is essential to use the particular frequency which produces a clean and neat cut without carbonization. Cuts thus made may be sutured and will heal by primary union. However, if the coagulation current is applied for a prolonged period, to stop bleeding or for other purposes, it produces considerable coagulation or carbonization of tissue, which must be removed or sloughed before the wound heals. Healing of such wounds is slow and frequently requires six to eight weeks.

DISEASES TREATED BY SURGICAL DIATHERMY

The accuracy of control of the dessicating current makes it extremely valuable in the treatment of small lesions where cosmetic results are important. The spark for this work should be very fine, clean and not feather.

1. With this type of spark, flat, *Pigmented Nevi* may be removed with practically no scarring by its repeated use at monthly intervals in a cribriform pattern over the lesion. On all connective tissue and keratotic nevi, it is an accurate and rapid destructive measure, with minimum scar formation. Hairy nevi should first be epilated by irradiation before

removal of the connective tissue or verrucous part of the lesion by dessication.

2. The papular and telangiectatic types of *Adenoma Sebaceum* respond without scarring. In x ray telangiectases, dessication is a most valuable agent by which these disfigurements can be eradicated, when superficial, usually without scarring. In the treatment of telangiectases and dilated venules, such as occur in rosacea and upon the thighs of women, the very small spark is run from the point of a sewing needle along the line of the vessel. It is a rapid, quite painless procedure, giving excellent results.

3. In *Xanthelasma*, under novocain, it is superior to acids because of its delicacy and accuracy in limiting the area of destruction. It is particularly applicable to *Xanthelasma* in blondes, because occasionally in brunettes the area treated is depigmented by the dessication and the result is a white or light colored patch, almost as objectionable as the lesion before treatment.

4. *Senile Keratoses* are easily removed in a similar manner.

5. Epilation of *hypertrichosis* with this current has been successful, but I have had no experience with it, and have felt that the danger of scarring would be enhanced by the short exposure times, ranging from one-tenth to one-fourth second, during which the needle is allowed to remain in the hair follicle.

6. In *Plantar Warts*, dessication has such definite advantages over x rays and radium that I seldom use the latter agents unless the patient objects strenuously to any pain. The pain from dessication of plantar warts is usually trivial after the operation, and is caused principally by the introduction of the novocain, and may be lessened by previous anaesthetization with ethyl chloride.

7. In *Molluscum Contagiosum*, dessication is a rapid effective method which leaves scarcely noticeable scarring, but in profuse cases the multiple injections of novocain are so annoying to the patient, as well as the operator, that I prefer the manual expression of the contents of the lesion, and cauterization of its center with pure carbolic acid.

8. Dessication is also used on small, common, filiform and genital *Warts* with facility and advantage. Coagulation by the bipolar method is preferable to dessication on profuse warty growths of either the vulgar or

genital types, and upon large plantar *Warts*, *Callosities* or *Corns*.

9. In *Lupus Vulgaris*, no method gives more rapid cures than coagulation followed by intensive ultra violet light to the area treated.

10. Coagulation is preferable to dessication in the treatment of the discoid type of *Lupus Erythematosus*.

11. In *Tuberculosis Verrucosa Cutis*, rapid cures are obtained by coagulation.

12. Deep coagulation is a superior method of treatment for *Carbuncles*, and gives immediate relief from pain and a sterile wound which heals with a minimum scar formation.

13. In chronic pyogenic *Ulcers*, *Chancroid* and *Granuloma Inguinale*, coagulation is a rapid and effective treatment.

14. Coagulation is of foremost importance in the treatment of *neoplastic disease*. Extensive resections may be made by this method in areas in which the surgeon fears to tread. Where the lesion involves bone or periosteum, the diseased areas may be coagulated and removed with facility. The classical method of attack for neoplasms is first to coagulate a zone of healthy tissue surrounding the lesion. This isolates the neoplasm, which is then coagulated, and subsequently removed with a cutting current by making an incision close to the healthy tissue, or using a cutting loop as a snare under the lesion. The coagulation and searing closes the blood vessels and lymph spaces and mechanically prevents the dissemination of viable cells and subsequent metastasis. For coagulation of neoplasms, it is frequently advisable to insert the needle electrode deep into the tissue surrounding the neoplasm, in order to obtain deep destruction of a cup shaped area. By using gentle pressure, coagulation precedes the progress of the needle point. When the lesions are superficial and small, a flat circular electrode is preferable to a needle, and this is applied over the surface of the lesion, which can be coagulated to a depth of two or three centimeters, without any traumatism from the insertion of needles. *Sclerotic* or *osteogenic Tumors* require more powerful currents than softer lesions.

Keloidal scars may develop after endothermy, as they do after other surgical treatments. They seem less frequent after superficial dessication than after deep coagulation.

The cutting current may be applied from a

needle, a small knife blade or various sized wire loops. The needle and small knife blade are especially adapted for the removal of the tongue or portions of that organ, or for the circumvention of local malignant growths of the skin or mucous membrane after these growths have been coagulated. The hemostatic advantages of the cutting current in the treatment of carcinoma of the tongue are of decided value. The large wire loops are useful for the snaring of papillomatous growths. With the small wire loops, biopsies may be readily and rapidly made without bleeding and without injury to the piece taken for biopsy. Biopsies made with the dessicating or coagulating currents are valueless, because the currents employed to remove the tissue cause so much injury to the piece of tissue taken for examination that it does not stain well, and in major portion is coagulated or charred. Upon mucous membrane lesions, sufficient local anaesthesia is given by absorption of novocain from surface applications for biopsies to be made with a small loop. This method of taking biopsies seems to give a minimum amount of danger of dissemination of the growth into the blood and lymph channels.

THE TECHNIC OF OPERATIONS

It is imperative when using endothermy that no alcohol or other inflammable liquid be used upon or near the area to be treated, as the spark will set fire to any such liquid. Thorough scrubbing with tincture of green soap and sterile water is usually sufficient disinfectant. When tincture of iodine, alcohol, alcoholic solution of picric acid or benzine are used on the area before treatment, they should be thoroughly dried before the spark is applied.

Cosmetic dessication of superficial lesions usually requires no anaesthesia. It is advisable to test the size and character of the spark upon a metal instrument before using it for treatment. The spark for most lesions should be clean, cold, regular and not feather. The fineness and accuracy of this method has superseded many older less accurate destructive measures, especially the caustic acids and alkalis and carbon dioxide snow. The Oudin current may be applied to the lesion by a sewing needle directly connected with the generator by a cable, or the patient may grasp an indifferent electrode so connected, and the operator may draw the current from the lesion with a sewing needle held in the operator's

hand. The fingers of this hand or of the operator's other hand are placed in contact with the patient, and by increasing or lessening the amount of this contact, the intensity of the spark drawn from the lesion by the sewing needle may be regulated. For dessication of mucous membrane lesions, sufficient anaesthesia is given by absorption of surface applications of novocain. For hypertrichosis no anaesthesia is used. For warts, novocain is used by injection.

The use of the coagulating current always requires local or general anaesthesia. For local anaesthesia it is best to anaesthetize a split pea sized area by an ethyl chloride spray and introduce the needle for novocain into the spot so anaesthetized. Wherever there is suspicion of malignancy, general anaesthesia should be given unless satisfactory desensitization can be obtained by injections of novocain far beyond the affected areas without introduction of the needle into or below the growth. Many large destructions can be done under morphine, hyosin or cactin. For general anaesthesia, gas and oxygen, or ether are advocated. With ether the patient is best anaesthetized with a cone in an adjoining room and then rolled into the operating room. It is safe to etherize the patient in the operating room if the windows are open and the can of ether is kept well away from the spark. Rectal and spinal anaesthesia are occasionally useful.

Pain and charring are proportionate to the heat of the spark. A cold spark is always preferable to a hot spark except for hemostatic purposes. Charring is always inadvisable. It forms a carbon barrier superficially over the treated area which restricts the deep action of the current and prevents penetration.

The use of a bipolar current requires an indifferent electrode. This is conveniently attached to an aerial such as is used for x ray machines. It may be a flat metal electrode placed under the hips of the patient, or a tubular electrode held in the hand of the patient, according to the severity of the operation. Much time is lost and annoyance caused by patients dropping the tubular electrode at critical moments during operations.

It is always best to remove desiccated or coagulated areas because of their susceptibility to secondary infection if they are left in place, except where the destruction is very

superficial. In this case, for cosmetic purposes less scarring seems to be obtained by not removing the thin, desiccated layer. For removal of destroyed areas, the curette, forceps and scissors, or the cutting current are used. Wet dressings with boric acid solution or dressings with a thin layer of 1 per cent chlorazene in cold cream on gauze are recommended. Collodion dressings should never be employed, as the oozing which usually follows treatment makes them ineffective and liable to secondary infection.

In the use of the cutting current, when large blood vessels are encountered, the electrode may be pushed directly into the bleeding area, or the vessel may be grasped with forceps and the electrode applied to the forceps about two inches above the tissue. The current then courses down the forceps and coagulates extensively the bleeding vessel.

PHYSICAL AND CHEMICAL EFFECTS

The cutting current is the most valuable development of the endotherm. Its exponents have claimed its advantages due to the fact that it is a bloodless method. In a manner, this is true and it is marvelous how well hemorrhages are controlled. However, in most work some bleeding occurs every time, although the majority of the capillaries are ordinarily closed. The application of the current to the tissues causes other changes which deter metastasis. It produces heat, steam, nitrous fumes, ozone, ionization, liberates electrons analogous to the beta rays and electromagnetic vibrations similar to soft x rays or ultra violet rays. The latter are of minor importance, being incomparable with those used in x ray or radium therapy, but the sum total of all of these chemical and physical products is sufficient to produce sterilization, both of bacteria and of malignant cells. Heat, nitrous fumes and ozone are definitely sterilizing agents. When the flight of an electric spark is suddenly stopped, electromagnetic vibrations always occur; but with such a tiny spark they probably have a negligible value. Little is known of ionization. It may have a sterilizing influence.

The physical cause of cutting effects is not known. In so much as in certain types of apparatus the rate of cutting is little affected by the accompanying heat or coagulation, it would appear that the cutting is probably not a pure heat reaction, although heat may have some-

thing to do with it. The ordinary diathermic apparatus, not designed for cutting, will coagulate and produce all of the heat effects of the surgical diatherm, but will not cut. Apparently voltage has little to do with cutting. The cutting is caused by continuous undamped oscillations at a rate of from 800,000 to over 1,000,000 per second. It has been suggested that the rapidly alternating spark frequencies cut like a saw. In electrical phenomena we have magnetism, heating effects employed for the production of heat or incandescence, coagulation, chemical disintegration and electrostatic effects. When a tree is struck by lightning, it is cut without production of notable heat. Trees which are burnable rarely burn and seldom does lightning set fire to houses, although occasionally it does. However, the destruction caused by lightning is obviously not due to thermal action. In electrostatics, we have the phenomena of attraction between a piece of amber rubbed vigorously by a rubber comb, and the phenomena of repulsion exhibited by two similarly charged pith balls. It is possible that the cutting effects are due to electrostatic changes in molecules of a similar character, so that molecules are pushed apart by the force of repulsion leading to a cut. Water and animal tissue have approximately the same density, due to the large percentage of water in tissue. It is estimated that the temperature of the cutting spark is about 3,000 degrees Fahrenheit, although this is not definitely known. The sudden application of this intense heat may cause the cells to explode with bursting steam that rends the tissue apart. It is very probable that the heat is not so intense with a cold spark, because frequently searing may be so slight that oozing is present immediately after the cut is made.

ABUSES OF ENDOTHERMY

Fads are of common occurrence, even in science. Endothermy, being a new method of proven real value in some affections, has received acclamations from enthusiasts which have been more injurious than beneficial. The spark is devoid of mystic power. It is not a cure for cancer. The consensus of opinion of experts who have used surgical diathermy or watched the results of its use is that it is not the best method for the treatment of any sort of malignancy. The claim has been made that endothermy has the enormous advantage over ordinary surgery of destroying the ma-

lignancy before removing it. Theoretically, this may be correct; but it must be remembered that endothermy *per se* is simply a method of removal of diseased tissue and its beneficial effects do not extend outside of the zone of destruction. In this manner, it is analogous to surgery and differs from x rays and radium, which because of their penetration and selective action destroy malignant cells far beyond the area to which they are applied.

In practically all malignant cases treated by

surgical diathermy, it is well to combine this treatment with irradiation both locally and to the draining lymphatics about the diseased area and in the neighboring chains of glands. Endothermy is a convenient, useful and destructive procedure by which lesions, which have heretofore been removed by other measures, may be more quickly and easily eradicated, perhaps in a few instances with better advantage. There are very few cases in which endothermy alone has cured any malignancy in which ordinary surgery failed.

Valence Changes in Tissue Due to Stimulating Ray Therapy: Some Theoretical Considerations*

BERNARD E. McGOVERN, M. D., B. Sc.
(House Physician Glockner Sanatorium and Hospital)
Colorado Springs, Colorado.

IT is not the purpose of this dissertation to attempt giving the specific effects of the different wave lengths of rays, nor to attempt giving tables of dosage for the different kinds of rays used in therapy; but to briefly sum up the physics of matter and rays, and to consider the general effects of rays upon tissue, with special emphasis upon some theories relating to *valence changes* in tissues due to some of the stimulating rays, as the ultra violet and x rays.

The electron theory of matter, insofar as it has been demonstrated, shows that the atoms of the universe are composed of positive electric charges called *nuclei* or *protons*, surrounded by various numbers of negative electric charges or *electrons* in rapid motion and possessing energy. The electrons occupy various energy levels or shells and are held in place by the electrostatic pull of the proton, which exerts its force inversely as the square of the distance.

No mention will be made of the *alpha* rays, which consist of helium atoms, each minus two electrons, nor of *beta* rays, which consist of streams of free electrons.

All transverse electromagnetic waves from the longest wireless rays thousands of meters in length, to the shortest gamma rays of radium, with wave lengths of a fraction of an Angstrom unit (an Angstrom unit = .0000001 millimeter) are of the same nature, varying only in wave length and vibration frequencies.

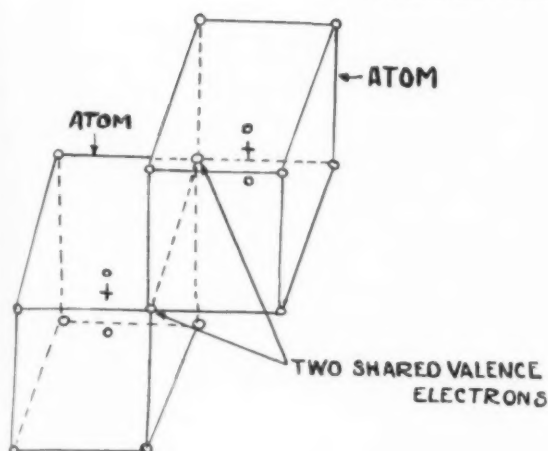
The shorter waves have the higher vibration frequencies.

The electrons in an atom, especially those close to the nucleus, try to arrange themselves in stable groupings around the proton or nucleus. According to G. N. Lewis and other investigators, the most stable arrangement consists of electrons arranged in pairs in the inner shells, and in groups of eight in the outer shells. This arrangement seems to form closed magnetic circuits and, therefore, insure stability; but, owing to various factors, this ideal arrangement cannot always be attained. Atoms also try to arrange around themselves enough electrons to neutralize their proton (positive) charges, and thus imitate atoms of chemically inert substances as helium and argon.

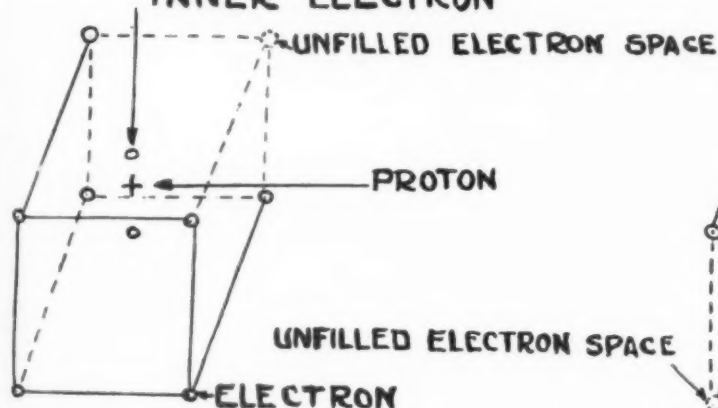
G. N. Lewis describes *valence* as being due chiefly to atoms not having enough electrons to complete their stable configurations with pairs of two and groups of eight electrons. This lack occurs in the outer shells, and these he calls *valence shells*. As a result two atoms share a pair of electrons between them, and in the binding together of the atoms by this shared pair of electrons consists *chemical valence*.

Langmuir and Harkins, on the basis of the Lewis theory, assumed that cohesion and adhesion were due to valence electrons placed farther out or raised to a position farther out than the chemical valence electrons of Lewis and, being in shells farther out, their binding effect would be less intense.

*Received for publication August 7, 1925.

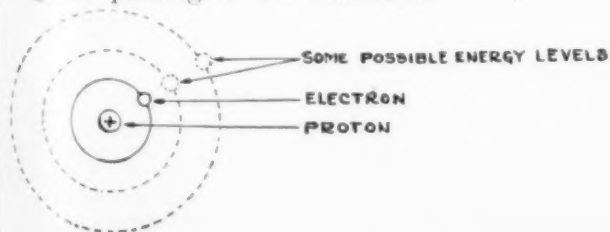


TWO ATOMS JOINED BY VALENCE ELECTRONS.
INNER ELECTRON



The older polar theory of chemical valence assumed that chemical union was accomplished solely by electrostatic tension, due to differences in charges on the joined atoms. This theory seems hardly tenable on account of its limited application.

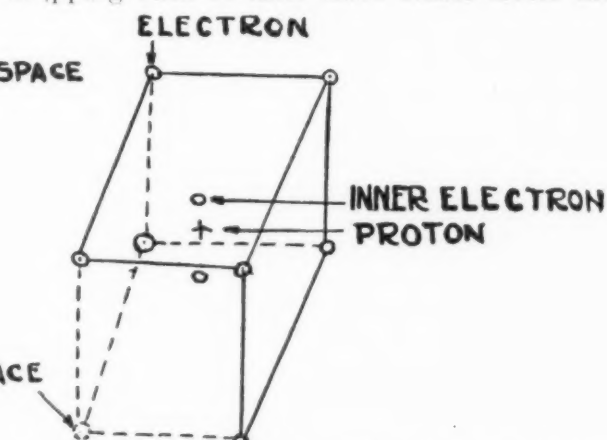
Bohr originally assumed that atoms contained different energy levels arranged spherically around the protons. He assumed that electrons can be made to occupy higher or lower energy levels under certain conditions. The hypothetical geometrical placing of the electrons has since been modified by Bohr, Lewis and others. The spectrum data point to a spherical placing of the shells, while the chemical evidence and the data obtained from x ray photographs of crystals point to a more angular placing of the electrons.



Hydrogen atom with its electron in the stable inner level. Some other possible levels are shown in Bohr atom.

By combining the two views concerning the figure of the atom more compatability may be obtained.

From experimental evidence it seems most probable that electrons can be raised from lower to higher energy levels by absorbing certain definite quanta of energy. Such energy may be supplied by such things as molecular impact, electron impact, electrostatic pull of other atomic protons or electromagnetic rays whose frequency corresponds proportionately to the vibration period of the electron. On dropping back to their more stable levels the



electrons give off their acquired energy in the form of electromagnetic waves characteristic of the substance excited, and bearing a relation to the exciting force.

The different levels, beginning with the inner or more stable levels, are designated *K*, *L*, *M*, etc. If an electron from *L* level drops into the *K* level, the spectral line is called *Ka*. If an electron from the *M* level drops into the *K* level, the spectral line is called *Kb*, etc.

Planck's quantum theory, as modified by Einstein for the absorption and emission of rays by atoms, briefly is: Rays can be absorbed or emitted only in the amount $h\nu$, where h is a constant corresponding to the proportionate vibration frequency of all electrons; and ν is the vibration frequency of the exciting ray. $H\nu$ is always a finite amount and is called the quantum. No electron can be forced into a shell already occupied, and, therefore, no atom whose shells (levels) are filled can absorb or emit rays until an electron has been thrown clear away (ionization).

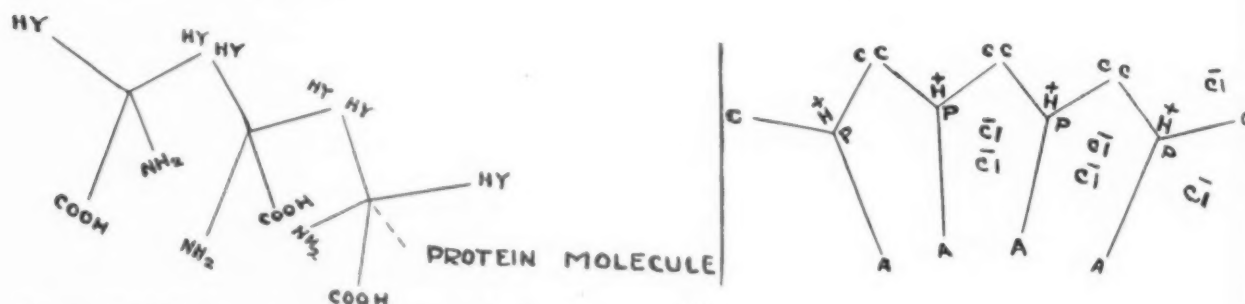
To ionize an atom requires rays of very high frequency, as gamma rays, x rays and the

shorter ultra violet rays. Atoms of high atomic weight seem to hold their electrons with greater electrostatic force on account of their heavier positive (nuclear) charge. Electrons in lower energy levels are held more stably than those farther out, and, therefore, require rays of higher frequency (greater energy) to raise them to higher shells.

It is known that rays such as the short ultra violet, the gamma and x rays will break loose and scatter groups of more or less free electrons that collect upon the surfaces of certain bodies and objects. It has also been

(mostly cohesion) which holds the protein molecules together. In the protein are certain groups as the NH_2 and COOH groups, which are strongly attracted to water. It is by these that the protein is brought into solution.

There are also certain hydrocarbon groups which are strongly attracted to each other. Under certain definite conditions the attraction of water for the COOH and NH_2 groups brings the protein into solution, while the attraction between the hydrocarbon groups causes the molecules to cohere, thus forming a network or gel.



shown that these rays will tear out the electrons in the outer shells of atoms and even from the inner shells. The higher the wave frequency, the greater is this effect, the shorter rays being required to tear out the inner electrons. Now, as living tissue is made up of atoms, molecules and groups of comparatively free electrons, all arranged in complex fashion, it follows that rays produce similar physical and chemical changes upon tissue, the effects varying with the character and arrangement of the constituent elements.

Since living tissue is largely in the colloid state and also has to do with membranes, electrolytes, varying electrical potentials, cohesion, adhesion, etc., it will be necessary to briefly consider some of these factors.

A brief description of a gelatin colloid will sum up some of the characteristics of living and inanimate colloids in general. Of course, a tissue colloid is a much more complicated affair, and many other factors besides the mere colloid state enter into the mechanics and dynamics of life. The following idea of a colloid was gleaned largely from the works of Jacques Loeb:

A protein, like any other substance, goes into solution because it contains radicals or groups whose secondary valence attraction (adhesion) for the molecules of the solvent is greater than the secondary valence attraction

Given:

Protein in solution;

Hy = hydrocarbon groups adhering;

The NH_2 and COOH groups are attracted by the water;

A network or gel is formed.

A Donnan's membrane equilibrium is brought about when a semipermeable membrane separates two solutions of electrolytes, one of the solutions containing one ion which cannot pass through the membrane. The ion which cannot pass through will hold back one ion of the opposite charge and thus produce an unequal distribution of the diffusible ions on each side of the membrane. The solution having the nondiffusible ion will have the most ions and the osmotic pressure exerted on this side of the membrane will be greater, thus causing the imbibition of water.

Proteins at definite hydrogen ion concentrations will form salts with either acids or alkalies. In the former case the hydrogen ion combines with the protein molecule to form a complex plus ion, while the Cl^- ion contains the negative charge. In the second case the metal of the alkali forms the cation (bearing the plus charge).

Proteins are least soluble at the iso-electric point; *id est*, when they are not ionized.

If nonionized gelatin chloride is put into water and a small amount of HCl added, the swelling of the gel will be increased up to a

certain point. But if this concentration of HCl be exceeded, swelling will be inhibited by the addition of the many ions bearing the opposite charge (the Cl ions).

The hydrocarbon groups cohere and adhere, forming a network. The protein cation cannot diffuse out of the gel, but the other ions can. This will result in a Donnan's membrane equilibrium between the inner and outer phases of the gel, with most of the diffusible ions in the inner phase, and consequently a greater osmotic pressure is exerted on the inner phase with the imbibition of water and increased swelling of the colloid.

Given:

Gelatin chloride;

C = cohering groups (hydrocarbon groups);

A = adhering groups (COOH and NH_2);

H and P = complex protein-hydrogen cation;

Cl = negative chlorine ion, of which there are more in the inner phase than in the outer.

Certain concentrations of salts increase solubility of proteins (iso-electric), probably by some of the adhesion valence groups of the salt attracting the protein molecule. At higher concentrations of salts the protein is precipitated, by the salt producing a chemical change in the protein wherein the protein now has less free adhesion valence groups to attract water than it has cohesion valence groups that attract the molecules together. Lesser concentrations of sulphates are required to precipitate proteins than some other salts.

Low concentrations of salts, regardless of their chemical nature, depress the swelling of ionized proteins by addition of ions of the opposite charge. The greater the valence (which in ionized salts means a greater charge), the greater the depressing effect.

It seems highly probable that the more normal tissues of the body are composed of molecules, radicals, atoms and groups, which are more stably bound together by their chemical valence electrons and their secondary valence electrons (adhesion and cohesion valence electrons). Also these various tissue elements are bound to other tissue elements whose configurations fit together and make for normalcy and stability. Pathological tissue, in general, is less stably organized. Its molecules probably are attached together by fewer adhesion and cohesion valence electrons and by electrons in

shells too far from the protons. The molecules probably have radicals and elements attached which are not normally present and some of its normal radicals, atoms and molecules may be attached by chemical valence electrons too far from the proton to form stable normal unions.

It is now pretty generally recognized that the effects of rays upon pathological tissue is largely due, in most cases, to the stimulating effects of rays upon the more normal tissue and blood which cause the more normal tissue to absorb the less stably organized pathological tissue. Of course, the local effects of the rays upon the more pathological, which is less stably arranged and more easily broken down, is recognized by all.

The stimulating effects of rays are accomplished largely indirectly through the nervous system, blood and lymph systems. Local and general blood and lymph supplies are increased, while organs are stimulated to increased function. The more normal tissue thrives and feeds upon and at the expense of the pathological tissue. Most of these effects are accomplished through the agency of hormones, catalysts, enzymes, vitamins, antibodies, chalone, bacteriocidal enzymes, phagocytes, etc. These agents, in their final analysis, are probably complex valence changers and carriers. Health and disease seems largely to depend upon valence state and valence change.

When comparatively normal tissue is given stimulating doses of rays some of the surface charge of nearly free electrons is broken off; some of the electrons in the outer shells of the atoms are broken off, leaving shells with uneven numbers of electrons, which thereby become primary valence (chemical) and secondary valence shells (cohesion and adhesion). Some of the inner electrons are raised to outer energy levels, where they can act as valence electrons. Some of the valence electrons (both primary and secondary) are freed from their attachment to abnormal radicals, atoms and molecules. But during these changes not too many of the valence electrons (primary and secondary) which hold the radicals, atoms and molecules in their normal symmetry, are disturbed. The various more normal lost components are then gotten back from the blood stream and from the more pathological tissue. And since more valence electron groups are now freed, the normal tissue

will be able to take up more of its stable components, thereby producing a growth effect.

The same thing occurs in pathological tissue, but in pathological tissue there are more abnormal valence attachments, and when these are disrupted the components of tissue which are able to hold their symmetry begin to regenerate by forming new and more stable valence attachments. Intense local raying tears out and changes the state of enough electrons, inner and outer, to make rearrangement impossible.

It is possible that in cancer and in some other pathological conditions, whether due to short rays, chemicals, bacteria, trauma, heat, etc., that a more or less surface isomerism occurs. The new arrangement of the electrons and protons is such that new radicals, atoms and molecules are allowed to be attached and new, unstable, unsymmetrical molecular and atomic attachments occur. The valence groups which hold the molecules in their normal configurations are not present in sufficient numbers to hold the molecules in their proper relative positions with the surrounding tissue. The raised and changed electron groups which attach abnormally are in preponderance. There occurs a lack of certain valence groups which attach to the normal radicals, molecules, atoms and other constituents of healthy tissue.

SUMMARY

1. The G. N. Lewis and Langmuir theory of valence assumes that valence (both primary and secondary) is due to lack of saturation in electron shells; the atoms, having uneven numbers of electrons in certain shells, share these electrons and complete their saturation number. In the shared pairs of electrons consist valence.

2. It is probable that disease and health has to do largely with valence electron change and state.

3. It seems probable that stimulating doses of rays affect chiefly the valence electrons.

4. Cancer and some other pathological conditions are probably due to a more or less surface isomerism, wherein the primary and secondary valence groups are raised to new positions, allowing only a few of the valence groups which hold the cells in their normal symmetrical relations with the other tissues to act, while the valence groups which attach to abnormal radicals, atoms and molecules and the valence groups which attach unsymmetrical to other normal molecules, atoms and radicals are in preponderance.

REFERENCES

1. *General Physics for Colleges*. Webster, Farwell, Drew, 1923. The Century Co., New York.
2. *Valence and the Structure of Atoms and Molecules*. Lewis, 1923. J. J. Little & Ives Co., New York.
3. *Atoms and Rays*. Sir Oliver Lodge, 1924. George H. Doran, New York.
4. *Ultra Violet Rays*. Hall, 1924. C. V. Mosby Co., St. Louis, Mo.
5. *Proteins and the Theory of Colloid Behavior*. Loeb, 1924. McGraw Hill Book Co., New York.
6. *Physiotherapy Technic*. Samson, 1923. C. V. Mosby Co., St. Louis, Mo.
7. *The Electron*. Millikan, 1924. University of Chicago Press, Chicago.
8. *Medical Electricity and Rontgen Rays*. Tousey, 1921. W. B. Saunders Co., Philadelphia.

M
grea
mos
cure
od c
geon
the
and
deat

In
geon
resu
relia
nosis
"his
ciati
canc
this
fact
whic
a pe
that
anyt

Th
that
artic
mean
or c
alwa
case
surg
the

Th
canc
class
was
each
surg
a dy
very
by g
hope
opera
on su

*R
lishe
1925.

Carcinoma and Sarcoma of the Esophagus: A Plea for Early Diagnosis*

CHEVALIER JACKSON, M. D., Sc. D.
(From the Bronchoscopic Clinic, Philadelphia.)

MALIGNANT disease of the esophagus with its 100 per cent mortality is one of the greatest reproaches to surgery today. In almost all other fields at least a few cases are cured. While I cannot bring forward a method of cure, I can, I think, show why the surgeon has never had a fair chance to attempt the cure of these wretched sufferers inevitably and invariably doomed to a slow and painful death.

In every form of visceral cancer the surgeon never had a chance to obtain curative results of value until there were developed reliable means of affording a positive diagnosis before it could be made by the classic "history of the case, pain, hemorrhage, emaciation and cachexia." Surgical treatment of cancer of the esophagus is still floundering in this slough of despond, notwithstanding the fact that a means of diagnosis is available by which an endoesophageal cancer no larger than a pea can be diagnosticated with a certainty that is as close an approach to infallibility as anything known to medical science.

The reason for this sad state of affairs is that the textbooks and most of the journal articles still ignore or slight the only early means of diagnosis and advocate exclusively or chiefly the methods of diagnosis that are *always negative in the early stages of the disease*. How, under these circumstances, is a surgeon ever to have a chance to deal with the disease in the early stages?

The ultimate history of nearly every case of cancer of the esophagus shows it to have been classed as a medical case until the patient was moribund from food and water starvation, cachexia, metastases and suffering. Then the surgeon was called in to do a gastrostomy on a dying man. Naturally the surgeon is not very enthusiastic over the results obtainable by gastrostomy on such a patient; and it is hopeless for him to try to develop a curative operation which of necessity is a major one, on such clinical material.

The responsibility for this state of affairs rests not upon the practitioner, nor upon the internist, nor the surgeon, but rather upon the general failure to recognize the fact that, while esophagoscopy is a rapid, safe and almost infallible means of making a diagnosis, it is so only in the hands of those who have sacrificed the time necessary to master the few but essential details of its technique. In the hands of the untaught, esophagoscopy is a dangerous and misleading means of diagnosis. The fault then is that too few men have considered it necessary or worth while to learn how to do esophagoscopy, and especially how to avoid the serious and fatal complications that are sure to follow, in a certain percentage of cases, the uninstructed attempts to pass the esophagoscope.

ETIOLOGY, INCIDENCE AND LOCATION

Irritant and Preexistent Disease. This is not the place to discuss the unsettled question of the etiology of cancer in general. It is conceded that irritation can be a factor in the localization if not in the actual cause of cancer (Coplin,²⁹ Ewing³ and others). The irritations peculiar to the esophagus are: (a) Those incidental to the passage, or, (b) stagnation of foods, and to the (c) regurgitation of the acid contents of the stomach. Our statistics show a preponderance of cancers at the lower end of the esophagus, which is the region most subject to irritation by all three of these factors. Statistics of cases in Scotland and in China, as pointed out by A. Logan Turner,¹ J. S. Fraser,² W. T. Gardiner³ and G. Ewart Martin,⁴ show a preponderance (2 to 1) of cancers in the upper third, and especially in the postericoïdal region, some indeed involving the hypopharynx. This preponderance is regarded by the authors referred to as possibly caused by the drinking of excessively hot tea by women of the working classes. This is especially striking because the total incidence of cancer of the esophagus shows relative rarity in women. The high cancers of the esophagus in China referred to by some authors as due to the eating of excessively hot rice, is a very important observation, but is not quite so striking because of the preponderance in men;

*Reprinted by permission author and publisher, Am. J. Med. Sci., 169:625-648, May, 1925.

but there seems to us little doubt that the relative insensitiveness of the esophagus to hot food or drink exposes it to injury from this cause in persons who have learned the trick of getting the hot food or drink past the relatively very sensitive anterior portion of the tongue.

One factor in irritation is stagnation. The esophagus normally empties itself downward without delay. If this is interfered with it tries to empty itself upward by regurgitation. Unlike the stomach, continued contact of food is abnormal and irritating. When to this are added the irritants quickly developed by fermentation of the stagnant food, we have an extreme degree of irritation that results in congestion and chronic esophagitis, as observed with the esophagoscope in hundreds of cases. While we have abundant esophagoscopic evidence of this static esophagitis and irritation as a factor in increasing the degree of stenosis and the rapidity of growth of cancer, our records do not indicate precancerous stenosis as a cause of cancer, certainly not as a frequent cause. Only about 5 per cent of our cases give a history indicating any delay in swallowing prior to what might be considered the onset of the cancerous obstruction. The 5 per cent of cases in which a preceding stenosis was probable includes cases of lye burns, pulsion diverticulum, probable luetic stenosis, probable spasmodic stenosis and pre-ventriculosis (so-called "cardiospasm"). In two cases histologically proven and ultimately fatal, cancer developed at the edge of a pulsion diverticulum. It thence descended into the esophagus in one case; the other was not esophagoscoped later, but may have extended in the same direction. In three other cases the history and enormous diffuse dilatation indicated a pre-ventriculosis (so-called "cardiospasm") as a predecessor of adenocarcinoma at the hiatal level. In making deductions as to preexisting stenotic disease, it is well to include only cases in which there remains objective evidence of the preexisting lesion. Esophageal cancer, if free from the synergistic starvation, badly balanced diet and local irritation, is a disease of slow progress. We have had cases survive as long as five and six years.

Our statistics approximately agree with those of practically all other observers in the preponderance of cancer at the normal points of narrowing, the cervical portion, the crossing of the left bronchus and the hiatal level.

The region of the crossing of the left bronchus is often referred to as the level of the aortic arch or the bifurcation of the trachea. The physiologic narrowing in this region, however, corresponds to the crossing of the left bronchus, as observed at esophagoscopy, which is the only reliable means of getting such anatomic data in the living. The left bronchus presses toward the spine; the aorta at a slightly higher level displaces sideways toward the soft tissues. No fault can be found with the theory that these narrowings expose the mucosa to greater irritation than the intervening portions, and the clinical history of cancer almost everywhere in the body shows a predilection for sites particularly exposed to irritation (Coplin,²⁹ Ewing³).

In sarcoma, especially lymphosarcoma, long-continued irritation and chronic irritation are conceded causes; but our three cases of sarcoma of the esophagus afford no evidence as to etiology. The lesion in one case of lymphosarcoma was not primary in the esophagus.

Age is undoubtedly an etiologic factor. Our youngest patient with cancer of the esophagus was nineteen years old, another patient was twenty-six years old; all the others were over thirty. About 75 per cent of the patients were between forty and sixty years of age, the sixth decade of life being the most susceptible. Our youngest patient with sarcoma of the esophagus was a boy, aged six years; another patient was thirty-two years; one patient with lymphosarcoma was aged forty-three years, the other, sixteen years.

Sex should be considered perhaps rather a cause of location than a fundamental factor in etiology, because the total incidence of cancer in the two sexes is not far from equal. The difference of cancer incidence in the esophagus in the sexes is very striking. In our cases men preponderate in the proportion of almost nine to one (87 + per cent). The statistics of A. Logan Turner¹ show a preponderance of women, approximately two to one. This preponderance of women, as pointed out by A. Logan Turner and J. S. Fraser,² may be related to the fact that the cancers were chiefly among women of a class who drink frequently of tea excessively hot, a habit not prevalent among men in the same region. Viewed in this light the large incidence in women is not directly a matter of sex. The converse is true in China, where excessively hot rice is eaten by the men (Fraser²).

Anomaly. In one of our cases we found a fistulous tract lined with apparently normal epithelium, situated about two cm. proximally from the upper border of the growth, in the middle third of the esophagus. Whether there was any etiologic relationship or not, we of course cannot say. The fistula seemed blind at its lower end on insertion of a fine forceps closed; no lower orifice could be demonstrated.

In two of our cases of histologically proven cancer the sections showed mucous glands similar to those normally present in the gastric mucosa. These embryonal errors may have been factors in the etiology of the malignant lesion by an inherent low resistance. It is more likely, however, that, as stated by James Ewing,⁵ "the sudden transition of epithelial types which they present offers a predisposing factor for epithelioma." In this connection it is interesting to note that of 16 cases of peptic ulcer of the esophagus at the Bronchoscopic Clinic, six were associated with the gastric glandular type of mucosa, as elsewhere reported.

PATHOLOGY

Type of Growth. In 671 cases in which a specimen was taken and reported upon as malignant the types of growth found were as follows:

Squamous-celled and atypical epithelioma.....	337
Basal-celled	2
Adenocarcinoma	316
Lymphosarcoma	2
Round-celled sarcoma	2
Fibrocarcinoma (epithelioma developing on scar?)	1
Squamous-celled, plus gumma.....	1
Squamous-celled, plus tuberculosis.....	1
Mixed, type uncertain.....	2
Ulceration but probably malignant.....	7

The foregoing does not include cases in which the specimen was reported negatively for malignancy, because in no such case did the progress, or any other phase of the case justify its inclusion in a list of malignant cases. The adenocarcinomatous type of growth was located in the lower third in almost all the cases. The squamous-celled type was found at all levels, but chiefly in the upper two-thirds.

Sarcoma of the esophagus has been observed four times at the Bronchoscopic Clinic. One

of these cases has already been reported.⁶

Mixed Lesions. That tuberculous, luetic and cancerous processes can be combined in a mixed lesion in the esophagus, though rarely, has been established. That any two of the three may be combined has also been established and is less rare than the triple combination. For an excellent review of this subject, with a comprehensive bibliography and the complete report of a well-studied case, the reader is referred to the article by L. W. Dean.⁷ Our statistics show a combined lesion of lues with cancer and of tuberculosis with cancer, but not of all three in one lesion in the esophagus.

In fourteen of our cases of histologically proven cancer a strongly positive Wassermann reaction was obtained. All of these patients had dysphagia. Antiluetic treatment improved the ability to swallow in 10 of the patients, but as gastrostomy was done in four and in all the others the diet was regulated to prevent stagnation by eliminating milk and solids, the improvement cannot be taken as conclusive evidence of a luetic lesion of the esophagus. In one case, however, the diminution of a large mucosa-covered nodular mass on the left wall (10, Plate II), as seen esophagoscopically after two months of saturation with mercury (11, Plate II), corroborated the diagnosis of a combined luetic and cancerous lesion. This patient ultimately died of cancer.

In another of the cases with a strongly positive Wassermann reaction the histologic examination by Dr. Ernest W. Willetts showed, in addition to a typical squamous-celled cancerous process, in an adjacent portion of the specimen of tissue, free from epithelial infiltration, the vascular changes usually associated with lues and necrotic tissue suggestive of gumma. No spirochetes or bacilli could be demonstrated. Tuberculosis could not be excluded histologically, but no clinically demonstrable tuberculosis process existed elsewhere in this patient. It seemed justifiable to consider this case one of combined lues and cancer of the esophagus. He died ultimately of what was reported by his physician to be salvarsan poisoning.

In a third case of strongly positive Wassermann esophagoscopy showed a reappearing purulent discharge from a fistulous opening with a mass of granulations at the margin. Tissue removed from this granulating area, examined histologically by Dr. Ernest W. Willetts,

showed typically tuberculous elements, though no bacilli were demonstrable in the tissue. One week later another esophagoscopy was done. A small tube (7 mm.) was used to pass the suppurating area. The lower margin of the lesion was found bleeding freely from a granular area, from which a second specimen was taken. The esophagus at this point was tightly strictured by a firm infiltration of the entire wall. The second specimen removed showed typical squamous-celled epithelioma. This patient had an advanced pulmonary tuberculosis with an abundant positive sputum. This was undoubtedly a combined tuberculous and cancerous lesion, though which was primary it is impossible to say.

In a fourth case, with strongly positive Wassermann, a squamous-celled epithelioma was found with a scar at its margin. Whether or not the scar was a cicatrized luetic lesion could not be determined. There was no history of swallowing a corrosive nor of difficulty in deglutition. The primary luetic lesion dated back twenty years. There was a small sacculated aortic aneurysm; the lungs were normal.

In two other cases in which a diagnosis of pulmonary tuberculosis had been made, with a dysphagia supposed to be adenopathic compression, esophagoscopy examination revealed an extension of malignant disease primary in the lung; in one case a glandular-celled carcinoma, in the other a lymphosarcoma. In both cases the pulmonary lesion was revealed by bronchoscopy. Without a diagnostic bronchoscopy neoplasms of the lung are often treated for months, even years, under a mistaken diagnosis of tuberculosis.

Multiple Primary Growths. In two of our cases two apparently separate lesions were found, the one about two or three cm. below the other, specimens from each showing the same type of growth, squamous-celled epithelioma. The esophageal mucosa between seemed normal. Whether or not they were instances of implantation metastases or of primary foci it is impossible to say; but there was no doubt about the isolation of the respective lesions so far as gross esophagoscopy appearances of the mucosa were concerned. The same condition may have existed in other cases, but it is only rarely that a cancerous growth is seen early enough to pass beyond it for exploration of the subjacent esophagus.

Metastases. Our records are so incomplete on the matter of metastases that it would be very misleading to give a summary. Unless the metastases were palpable in the neck, revealed in the ray or at the relatively few autopsies, no note was made.

Ulceration was present in most of the late cases of endoesophageal growths. It was more often apparent at peroral esophagoscopy than at retrograde esophagoscopy. It would seem, therefore, that the upper margin of the growth ulcerates earlier than the lower margin. In some cases the ulceration seemed to be an extensive melting away of the tissues with deep, sloughing, very foul areas. Some of these cases had a lumen larger than normal and had no dysphagia.

Location of the lesions in reference to the region is referred to under etiology. The location as to endoesophageal or periesophageal growths could not be determined positively in many of the cases because of the lateness of the stage of the disease at which the patient came in. The histologically evident types of structure, given in a foregoing paragraph, justify the inference that most of the esophageal growths start in the esophageal wall, and chiefly in the mucosa.

SYMPTOMATOLOGY

Early Symptoms. It would be better for suffering humanity if all mention of symptoms were omitted with the exception of those listed below as "early symptoms." Practically all other symptoms are so late that to enumerate them serves only to perpetuate the fatal fault of late diagnosis on which the present 100 per cent mortality of this disease depends. These symptoms may seem trifling and vague—and they are trifling and vague—so much so that the patient often fails to notice them or is ashamed to mention them, and the practitioner either ignores them or attributes them to hysteria or morbid introspection. Often the patient is given a tonic at the only stage in which there will ever be any hope of curing the disease. These most important early symptoms are not mentioned in the textbooks or journal articles. They are described by the patient in such vague and varying terms that it is difficult to formulate them; but we shall give them as nearly as possible in the patient's own words. In most instances these symptoms had not been connected by the patient directly with the later trouble and were recalled only after close questioning:

1. "Slight, queer feeling in swallowing; but food went down all right."

2. "A feeling of nervousness about starting to swallow; after starting, food went down without any trouble."

3. "A feeling of nervousness in the neck."

4. "Vague sensation about the neck as of something wrong."

5. "A feeling of cramp about the neck."

6. "A feeling as if my swallow was not working right, but nothing seemed to stick until here lately."

7. Food "sticking in the throat while eating in a hurry; but it went down itself all right, and I had no trouble for months afterward; though I did not eat in a hurry any more."

8. "A feeling as of a lump rising in my throat." This occurred in many cases. In some patients it had no relation to eating; in other patients it occurred at sight of food or thoughts of eating; in other patients at the beginning of a meal, but disappearing after a few mouthfuls had been swallowed.

The foregoing early symptoms were elicited by close questioning of the patients as to the onset of the disease. The patients were not sent in during this initial stage because neither they nor their physicians realized the importance of the symptoms. Many patients have stated that their physicians had said the trouble was "just nervousness." Evidently it was considered a "globus hystericus." This condition we know, even when occurring as a manifestation of hysteria, to be not imaginary, but a spasmodic contraction of certain cervical or pharyngeal muscles, usually including the *cricopharyngeus*;⁶ and such it seems to be in cases of foreign body and of organic disease of the esophagus, such as malignancy. When the spasm is excited by a malignant lesion this lesion is quite as often in the lower two-thirds of the esophagus as close to the *cricopharyngeus* muscle. In the cases in which the just mentioned vague statements were made by the patients the cancer was in most instances in the thoracic esophagus. This is not remarkable when we recall the insensitiveness of the thoracic esophagus and indefiniteness of localization of subjective sensations in this region. For instance, pain from a lesion in the thoracic esophagus may be referred to the back, the epigastrium, the neck,

the shoulder, or even to some more remote location.

Cough is sometimes an early symptom. Most cases of unexplained cough should be esophagoscoped as well as bronchoscoped.

Late Symptoms. It would be better for the development of thoracic surgery, and for the ultimate good of humanity, if the late symptoms were not mentioned at all. It is necessary, however, to include them here in order to present the palliative methods that have been found to prolong life and lessen suffering in the cases that have come to the Bronchoscopic Clinic.

Dysphagia, odynphagia, pain, weight loss, hematemesis, emaciation and cachexia are all hopelessly late, so far as any attempt at cure of malignancy is concerned. When encountered, however, they call loudly for immediate ray study and esophagoscopy to discover and cure benign conditions, and to establish early the palliative measures that will prolong life in hopelessly incurable, advanced cancer of the esophagus. Dysphagia, when fully developed and prominently complained of by the patient, means obstruction; and obstruction in a loose bag like the thoracic esophagus means a well advanced lesion. Food will pass a small growth. Dysphagia is noticed somewhat earlier in cancers at the *cricopharyngeal* and *hiatal* levels, but it is always a late symptom. One of the erroneous statements often made is that the dysphagia in cancer of the esophagus is progressive. In reality, as clearly shown by our records, it is, in its early stages, much more often intermittent; so much so that one of the commonest errors in inferential diagnosis is to exclude cancer because of sudden, recent onset. Many times we have removed a bolus of food in what was supposed to be a foreign body case and found a well developed cancerous narrowing of lumen. The bolus of food had stuck either because excessively large, too hastily gulped, or too ill masticated to go through the lumen, which was adequate for better masticated food. Afterward static esophagitis and engorgement from irritation of the growth may perpetuate this suddenly appearing dysphagia. Often the artificial dentures or lack of teeth, incidental to the cancer age and conducive to ill-mastication, are blamed wholly for the stoppage; when in reality they are only partly responsible, and might even be regarded as a blessing in disguise, as giving to the alert practitioner an early sign of cancer of the esoph-

agus. Only too often this early sign is ignored, sometimes even fatality results from an ill advised blind attempt to push the bolus downward with a bougie. Very frequently in cancer cases we get a history of such stoppage of a bolus which, however, had gone through spontaneously, resulting in an erroneous diagnosis of spasmodic stenosis by practitioners who did not realize that the day of inferential diagnosis of esophageal disease is past.

It is well to remember that dysphagia, odynphagia and spontaneous pain may be absent. In 22 of our cases the esophageal cancer had not produced any difficulty in swallowing. The lesion was discovered in the cervical esophagus in 16 cases referred for study as to the cause of a cervical adenopathy. In these cases the growth was small, but the metastatic leakage had been much earlier than is usual in the lower two-thirds of the esophagus. In the other six cases the absence of dysphagia was evidently due to the sloughing, liquefying nature of the growth. In these cases esophagoscopy was done in a search for the cause of melena.

Odynphagia and spontaneous pain are also very late symptoms, pain being later, perhaps, than in cancer in any other region of the body. There is often distress from irritation of stagnant food and co-existent esophagitis; but the typical cancer pain associated with cancer elsewhere usually comes very late. In many cases the pain is never so severe as that seen in peptic ulcer of the esophagus. Often the pain of cancer is less than that of esophagitis.

Hoarseness is nearly always present, in some degree, late in the progress of the case. Sometimes it is due to recurrent paralysis, as mentioned in the textbooks; but much more frequently it is due to an overlooked factor, namely, the overflow into the larynx of secretions and even of food and drink, owing to the subjacent esophageal obstruction. This most common cause of hoarseness has been overlooked in the literature. Occasionally it is due to arytenoid fixation from direct extension into the laryngeal motor mechanism from postericoidal cancer. When paralysis is present it is much more frequently unilateral than bilateral. Obviously paralysis can result only from growths or metastases high enough to involve the recurrent nerve fibers, roughly speaking, in the upper half of the esophagus.

Cough may be a late symptom from overflow of secretions into the larynx, because of

absent or defective esophageal drainage of normal secretions. This mechanism is often overlooked. In some cases a severe laryngo-tracheobronchitis may result. Cough may also be present as a reflex from the neighborhood of the growth. Cough, productive of secretions, blood or food, may be present from erosion of the growth through the wall of the trachea or a bronchus, oftener the left, or, occasionally, into the parenchyma of the lung, oftener the right.

DIAGNOSIS

There are only two means by which an early diagnosis of cancer of the esophagus can be made, namely:

1. Roentgen ray examination.
2. Esophagoscopy.

Only by these means will the diagnosis ever be made early enough to give the surgeon a chance to develop the technique of a curative operation; only by these means can efficient palliation be started in time to prolong the patient's life. All other means are *always negative in the early stages*.

Roentgen Ray Examination. All esophagoscopists will agree with Ellen J. Patterson that roentgen ray examination should always precede the esophagoscopy. In most cases the roentgenologist's diagnosis will be correct; for absolute certainty esophagoscopy should follow the roentgen ray examination. The fluoroscopic examination will reveal the esophagus in action; in other words, it permits examination of the *function* of the esophagus—something that cannot be got in any other way, not even with the esophagoscope. The fluoroscopic examination will not often reveal evidence of malignancy, but it will exclude aneurysm. This condition is not a contraindication to esophagoscopy, because no esophagoscopist would poke his tube into an aneurysm involving the esophagus, which, of course, he can plainly see ahead of his tube-mouth; but when the fluoroscopist reports a sacculated aneurysm against which the opaque mixture stops, or past which it slowly trickles, the diagnosis has been made and the indications for treatment are plain.

Ray films, especially a well made stereoscopic pair, interpreted by an experienced roentgenologist, afford a very reliable means of diagnosis, and, taken with the fluoroscopic findings, the ray diagnosis will rarely call for revision. One invaluable diagnostic point

afforded by the ray is information as to the lateral extent of the growth. This information can be had in no other way. As to the technical consideration of roentgen ray diagnosis the reader is referred to the articles by Manges,⁹ Pancoast,¹⁰ Pfahler,¹¹ Bowen,¹² Hirsch¹³ and many other scientific and skillful roentgenologists who have studied this problem and developed the technique to its present point of practical perfection.

It is necessary here to emphasize the necessity of attaching no importance whatever to negative ray findings except those of experts with the best apparatus. Many hospitals are handicapped in being unable to afford the best and latest of the frequently improved apparatus. Under these circumstances it is especially necessary to beware of negative findings. Even under these circumstances, if they cannot be bettered, it is in all cases necessary to resort to the ray examination as the first step in the diagnosis.

Esophagoscopy. This is the final arbiter which gives all the certainty of direct examination with the eye, yielding objective evidence that, taken with the roentgen ray examination, which is also an objective method, relegates all inferential methods to third place, if not to desuetude. All inferential methods, including the bougie, depend upon obstruction, whereas with the esophagoscope the walls of the esophagus are examined for the presence of lesions. Every crease and fold is exposed to inspection by the eye. The great safeguard in esophagoscopy as compared with the bougie and all similar methods is that you can see what is ahead of the distal end. You do not push when you see tissue, normal or abnormal, ahead of the tube-mouth. By the esophagoscopic appearances alone the diagnosis has been correct in about 92 per cent of the cases of endoesophageal cancer at the Bronchoscopic Clinic, inconclusive in 6 per cent, unconfirmed in 2 per cent. These figures omit consideration of biopsy; in no instance has a positive histologic diagnosis of cancer been proven erroneous.

With the esophagoscope we have been able to make a diagnosis before the stenotic stage in 28 patients, and we have every reason to believe we could have made it thus early in practically all the cases of esophageal disease that started endoesophageally if they had reached the esophagoscopist early.

If for any reason a first esophagoscopy is inconclusive, a second esophagoscopy or as many more as desired may be done. Being done without anesthesia, general or local, and, if the patient is in good condition, without hospitalization, it has sometimes been deemed advisable to study a case at esophagoscopies repeated every week or oftener. Prolonged fasting is unnecessary; four hours are deemed sufficient after liquid food. In a few weeks esophagoscopic and roentgenologic study has usually sufficed to clear away all doubt even in the most obscure cases of periesophageal malignancy.

To get a chance to make an early diagnosis of cancer of the esophagus, it is necessary to see patients before the development of more than a very slight degree of stenosis. As noted under symptomatology, very vague descriptions by the patient of early symptoms are often either overlooked or classed as "globus hystericus." It is to be expected that if every patient complaining of the vague symptoms referred to under symptomatology is esophagoscoped, many purely neurotic patients will be examined. But this is inescapable if cancer of the esophagus is to be diagnosed early. Over and over again we have made an inferential diagnosis of globus hystericus, or of a neurotic condition, passed an esophagoscope and found a cancer of the esophagus. There is no way in which to distinguish between the globus of hysteria and the globus of organic disease except by the esophagoscope. As elsewhere herein mentioned, the opinion of the roentgenologist is often decisive as to purely neurotic conditions, and should always be had before esophagoscopy; but usually the roentgenologist will advise esophagoscopy also. In no case is full justice done to the patient in making an inferential diagnosis of globus hystericus without the ocular evidence afforded by the roentgen ray and the esophagoscope.

Esophagoscopic Appearances. Endoesophageal malignancy develops at a very early stage characteristic and unmistakable appearances. These have been fully described (Jackson⁶), and are well known to esophagoscopists. Any one who has seen many cases of cancer in the pharynx and who is also accustomed to monocular vision through an endoscopic tube, will rarely, if ever, fail to recognize ulcerative, fungating cancer of the esophagus, such as illustrated in Plate II. Some delay in esophagoscopic diagnosis arises in the periesopha-

geal growths producing a compression of stenosis of the esophageal lumen. In these cases the presence of a hard stenosing mass palpable with the tube-mouth outside the wall and obliterating the soft, resilient unfolding of the normal esophageal wall (1, Plate II) is diagnostic to the experienced esophagoscopist. When these appearances are present the esophagoscopist will always consult with the roentgenologist who is able in practically every such case to outline the exterior border of a periesophageal growth. The internist will exclude pulmonary tuberculous and suppurative disease that might produce a secondary compressive adenitis, and lues will be excluded by the usual means.

Approached thus from four angles the diagnosis of periesophageal malignancy comes as near certainty as is possible in any neoplastic disease without biopsy. Certainly, the percentage of error will be small even if we were compelled to stop there. But in a large percentage of cases of periesophageal disease a subsequent esophagoscopy after a month or two will show the fungating form of lesion from which a specimen may safely be taken.

Anyway, it is not in the periesophageal, but in the much more frequent endoesophageal cancers that hope of surgical cure lies. In considering esophagoscopy appearances it must be remembered that mediastinal abscess may compress the esophagus; but it is softer to palpation with the tube-mouth or swab. At a later stage, when the abscess has discharged into the esophagus, the orifice of the fistula may be confusing, especially if granulations are exuberant; but the oozing of pus is usually quite noticeable; and, most important, in all such cases it is at once manifest to the esophagoscopist that a specimen may be taken with perfect safety. The histologic report will be decisive. If the first specimen be inconclusive, a second, or as many as desired, may be taken at subsequent esophagoscopies.

Peptic Ulcer. There is only one condition with which cancer is likely to be confused in esophagoscopy appearances, namely, that rare condition, peptic ulcer. Minor mucosal erosions of the esophagus are relatively common, and aphthous ulcers are not very rare; but large, deep ulcerations are so rare that many esophagoscopists of large experience have not seen a case. In all there have been 16 of these cases that have come to the Broncho-

scopic Clinic. All but two of them were in the lower third of the esophagus, and in six of them histologic structure suggestive of gastric mucosa was demonstrable. That all of them were located on islands of gastric mucosa is possible, but there was nothing to substantiate such a belief in any except the six cases. The esophagoscopy appearance of these peptic ulcers as elsewhere described by the author is not unlike the gastroscopic appearances of gastric ulcer. In all cases of suspected peptic ulcer of the esophagus, biopsy will decide with certainty.

Biopsy. In over 92 per cent of the cases the diagnosis by esophagoscopy appearances alone ultimately has been found correct. So far as a palliative treatment such as gastrostomy is concerned, no specimen need be taken, because such measures are strongly indicated anyway; but when it comes to a radical surgical procedure, such as transthoracic esophagotomy, the surgeon desires to have peptic ulcer, gumma, foreign body, esophagitis, cicatricial and spasmotic stenosis and other benign conditions excluded before undertaking a possibly fatal exploration. Histologic examination of an esophagoscopically removed specimen affords the absolute certainty that is necessary to get a man in good general health to submit to an operation of very high mortality. If the patient is not in good condition he will not survive the operation. During our more than thirty years' experience we have never had a histologic diagnosis of cancer based upon an esophagoscopically removed specimen found absolutely erroneous. Specimens sometimes are inconclusive, but when this occurs other specimens are taken. There are often cases in which we deem it unnecessary to take a specimen, and there are other cases in which we deem it unwise to take one. In the latter case a later esophagoscopy will usually reveal a lesion from which a specimen may be taken with safety. No anesthetic, general or local, is used. Esophageal lesions, neoplastic or otherwise, are insensitive to the taking of a specimen of tissue.

EXAMINATION OF THE PATIENT

As just stated, esophagoscopy is the one great and only method without which a diagnosis of esophageal cancer cannot be made early and without which a diagnosis cannot be made with certainty, even late. It follows, therefore, that esophagoscopy should be

done in every patient presenting any symptom whatever of the slightest abnormality in the swallowing function.

However, this does not mean that esophagoscopy is the first step in the making of a diagnosis. On the contrary, while it is first in importance, it is the last step in the orderly procedure by which a diagnosis of esophageal disease should be made.

The following are the steps in the procedure for the diagnosis of esophageal disease at the Bronchoscopic Clinic:

1. A complete history is taken.
2. Complete examination of nose and throat, including mirror examination as to (a) Defective motility of the larynx, (b) infiltration from extension of a hypopharyngeal growth, and (c) accumulations of secretions in the pyriform fossæ, indicating impaired esophageal drainage. Any or all of these may indicate esophageal disease. Severe dysphagia and odynphagia may be due to disease, benign or malignant, of the epiglottis, pharynx or larynx.
3. Physical examination, complete, including careful examination of the lungs, heart, circulation, etc.
4. Urinalysis, sputum test, hemoglobin test, blood count, etc.
5. Wassermann test.
6. Fluoroscopic examination first for aneurysm, then with an opaque mixture, as to the functioning of the esophagus.
7. Roentgen ray examination of the chest for disease of the pleura, lungs, heart and mediastinum as well as the esophagus; first without then with a swallowed opaque mixture.
8. Complete gastro-intestinal ray study. This sometimes is omitted, but omission is seldom advisable unless a hopelessly advanced cancer of the esophagus is discovered by the previous ray study.

Positive findings in any of the foregoing examinations do not necessarily obviate the necessity for an esophagoscopy, nor contra-indicate it. But extensive, painful, ulcerative tuberculosis of the epiglottis or larynx, for instance, with a fluoroscopically normal esophageal lumen and swallowing function, constitute a combination of evidence upon which we

often decide not to do an esophagoscopy or to postpone it pending further observation. If, however, fluoroscopy shows narrowing of the mediastinal esophageal lumen, as by glands or neoplasm, esophagoscopy may be called for in cases with tuberculous laryngeal disease. In malignant disease of the larynx, unlike tubercular laryngeal disease, esophagoscopy is of the utmost importance to determine contra-indicating metastases along the hypopharyngeal or esophageal wall. If there are nodular elevations or compression or infiltration of the wall of the thoracic esophagus indicating mediastinal metastases, laryngectomy is hopeless and contra-indicated (Jackson⁶).

A patient with lues or pulmonary tuberculosis may have cancer of the esophagus. We have seen quite a number of such coincident diseases, though rarely as mixed lesions, as elsewhere herein mentioned. We often decide, in case of a strongly plus Wassermann test, to wait for a thorough course of mercury before doing esophagoscopy for diagnosis.

ERRORS IN DIAGNOSIS

Practically all the errors in diagnosis of esophageal malignancy arise from dependence on methods that are always negative in the early stages and on inference instead of objective evidence. Of 110 cases of esophagoscopically proven malignant disease of the esophagus, in 87 an inferential diagnosis of neurotic conditions had previously been made either by ourselves, tentatively, or by our predecessors tentatively or positively.

One of the most common errors in the inferential diagnosis of esophageal disease based on the history of the case is to exclude cancer in favor of spasm because of the patient's positive assertion that he never had any trouble in swallowing until a few days or weeks previously, when suddenly a piece of meat or other food stuck because insufficiently masticated. This sudden onset of symptoms is very common in cancer (Turner¹). In many such cases at the Bronchoscopic Clinic we have found well-developed cancer which must have been present for many months. Any well-masticated food will, without difficulty, go through an esophageal lumen of six mm. diameter; yet an imperfectly masticated bolus will stick, for a time, at least. It is not until this happens that the patient's attention is called to any difficulty in swallowing. This explains the sud-

den onset. In other instances a sloughing type of growth may be at times only slightly obstructive. But why do the patient injustice of trying to make an inferential diagnosis of esophageal disease when the esophagus is open to direct examination of the eye by a simple and safe technique that requires no anesthetic, general or local, and no hospitalization; that involves no more annoyance than having a tooth filled; and that requires but a few minutes?

Apart from the vague "neurotic" symptoms elsewhere herein referred to, there is only one point in the history of the case that is of great importance in the early diagnosis of cancer of the esophagus, and that is the history of food having at some time or other stuck for a moment or longer. But this is not diagnostic. In other words the history of the case is of value chiefly as eliciting an indication for esophagoscopy. It cannot be too strongly urged that it should be part of all routine history taking in all hospitals to ask every patient, regardless of the chief complaint, these two questions:

"1. Have you ever noticed any trouble in swallowing food or liquids?"

"2. Do you remember ever having had food lodge for a time before going down?"

All internes should be thus instructed and all printed instructions for the filling in of history blanks should have these questions printed on them. By this means opportunities for early esophagoscopy diagnosis would be afforded and many diagnostic errors would be eliminated.

In 12 cases of cancer of the esophagus coming to the clinic the patients had an enlarged and diseased lingual tonsil, and in four of the cases we felt inclined inferentially to regard this as the cause of the dysphagia of which the patients complained. In all 12 cases, however, esophagoscopy revealed a cancer in the esophagus. In a number of other cases, however, esophagoscopy showed the esophagus to be normal. Therefore, while the lingual tonsil should always be thought of as a cause of dysphagia, as so well demonstrated by J. Arnold Jones,¹⁴ every such case should be esophagoscoped. Endocrine disturbance, as suggested by Mr. Jones, may be very intimately connected with globus hystericus and the vague sensations often noted in such cases; but malignant disease of the esophagus occa-

sionally at its very incipency gives rise to sensations quite as vaguely described by the patient. If we are ever going to diagnosticate esophageal and hypopharyngeal malignancy early, almost all of these patients must be esophagoscoped.

One of the most frequent of diagnostic errors arises from the use of the blind bougie, which is in reality an inferential method. Those who use it infer that when it goes through there is no cancer, though it may have gone through the esophageal wall into the mediastinum, or have passed a small early or late sloughing nonobstructive cancer; if it meet an obstruction they infer that the obstruction is cancerous, even though the obstruction may be normal wall; if it show blood on withdrawal, they infer that the blood comes from a cancer and not from normal or inflamed mucosa; if it be foul they infer that the odor comes from an ulcerating cancer and not from stagnant food and secretions, or a septic mouth, or septic faucial lymphoid tissue. There have come to the Bronchoscopic Clinic 21 cases of cancer of the lower end of the esophagus in which an erroneous diagnosis of cancer of the upper end of the esophagus had been previously made by the bougie. These erroneous diagnoses were all made with localization at about 15 to 17 cm. from the upper teeth, which is the level of the cricopharyngeal fold. This region was found normal at esophagoscopy except in the cases in which a false passage was found.

All esophagoscopists agree with the following admirable summary of Mr. Tilley,¹⁵ giving reasons why a bougie should never be used in a case of suspected cancer:

"1. It may fail to detect any obstruction when the growth is small, or even in advanced cases when rapid ulceration fails to produce stenosis.

"2. If an obstruction is met with, the bougie affords no more than presumptive evidence of its nature.

"3. Fatal results have followed the use of the bougie even in skilled hands, as a result of perforation of the thin diseased walls of the esophagus in the immediate neighborhood of the growth."

To this I should like to add a supplementary paragraph:

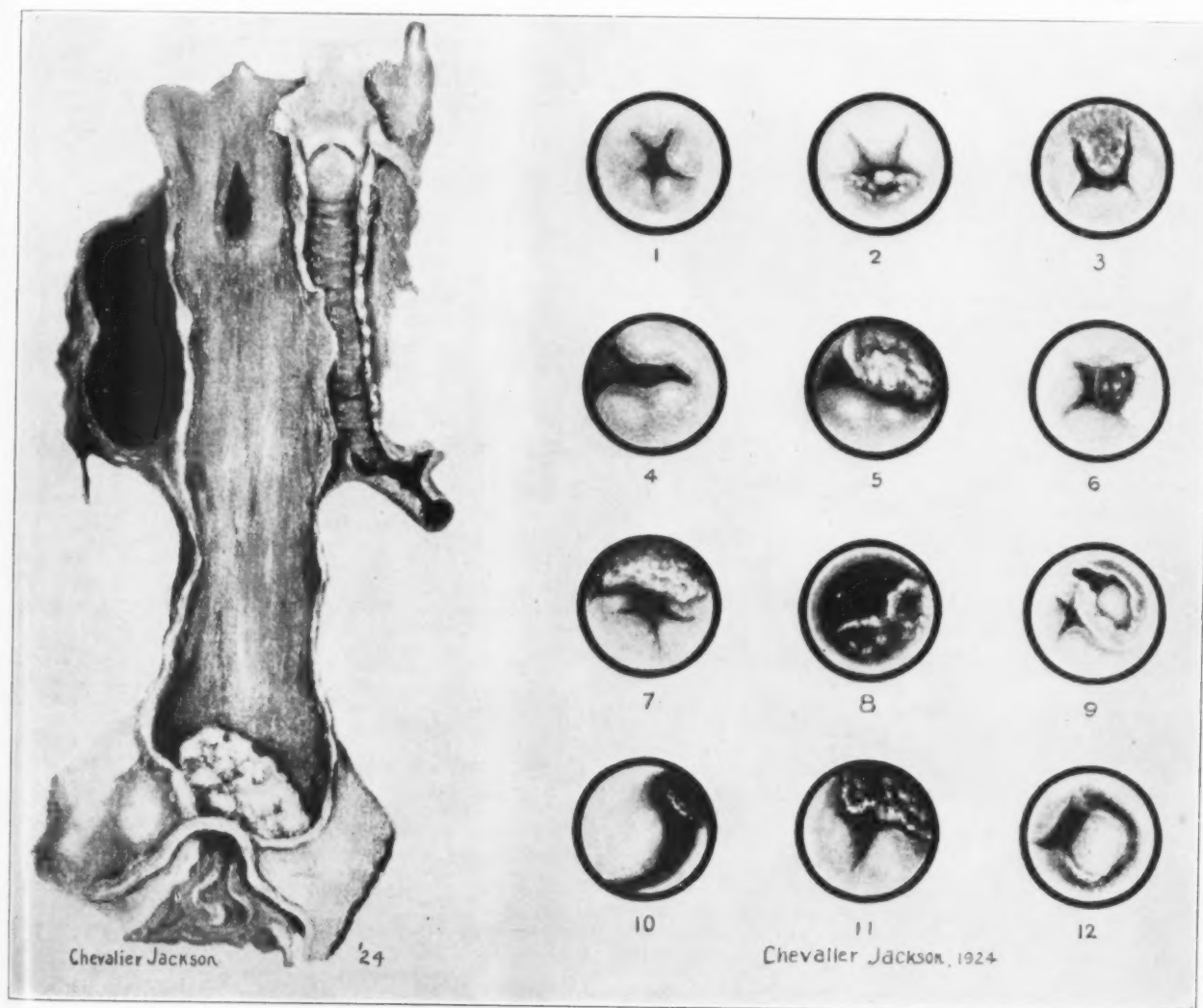
4. Fatal results have followed the use of the bougie as a result of perforation of the per-

fectly normal wall of the esophagus far above the growth in some cases, and in other cases in which no growth whatever existed.

Plate I illustrates a case of death from mediastinal hemorrhage due to blind bouginage in skillful hands. Arrowsmith¹⁶ and many others have reported similar cases in the literature. Similar cases are shown by specimens in many large medical and surgical museums in this

country and Europe. Trousseau said, in effect, that all these patients died sooner or later of the bougie.

If for any reason an esophagoscopist were unavailable we would abide by the decision of a competent roentgenologist, and under no circumstances would we submit our patient to the risk of the dangerous, inconclusive bougie.



DESCRIPTION OF PLATE I.

Illustration of the Misleading and Fatal Results of Blind Bouginage for Diagnosis. From a Postmortem Specimen by the Author.

The patient had been admitted moribund with mediastinal hemorrhage and emphysema. The trachea is opened through the "rings" to the right of the membranous posterior wall; the larynx is laid open from behind; the esophagus is split down the right wall as far as the diaphragm. The perforation evidently had been made by a bougie, shortly before admission, causing the fatal mediastinal hemorrhage shown by the huge blood clot. The edges of the perforation showed no histologic evidence of malignancy. The bougie had evidently gone through normal esophageal wall, where the lumen was not pathologically stenosed, above the cricopharyngeus, and far above the cancer, which is seen in the esophagus at the level of the diaphragm surrounded by a mass of lymph nodes under the pleura. The

danger of perforation by a blindly passed bougie through cancerous tissue is frequently mentioned, but the greater danger of perforation of the perfectly normal wall is not so generally realized. It is also noteworthy that this patient was treated for a supposed "cardiospasm" at three different clinics before reaching the place where an erroneous diagnosis of cancer of the cervical esophagus was made because the bougie was arrested in the neck and came back bloody! No esophagoscopy was done in this case because the patient was dying when admitted.

PLATE II.

Endoscopic Views of Carcinoma and Sarcoma of the Esophagus.

These views were sketched by the author from memory shortly after the respective esophagoscopies, hence represent a view of the interior of the esophagus at a certain level in the particular cases, the patient being in the dorsal posi-

tion in each instance. No anesthetic, general or local, was used, a fact which must be borne in mind when considering color. The sketches serve to illustrate the modern method of diagnosis of esophageal disease by looking at the lesion. They also show how accurately a specimen, when desirable, can be taken from any selected part of the lesion.

1. Normal esophageal folds as seen at the moment the esophagoscope enters the thoracic esophagus. The delicate pink, velvety surfaces, the soft folds flattening without resistance at the approach of the tube-mouth and yielding to the slightest manipulation of the tubal lip; the resilient respiratory recession and advance; the pulsatory movement of one wall at certain levels;—all these are, esophagoscopically, so characteristic of the normal esophagus, to the accustomed observer, that any abnormality in color, form or movement is instantly apparent. The sketch shows the image during the momentary pause at the end of the expiratory phase.

2. Whitish, nodular form of carcinoma on the posterior wall of the upper end of the esophagus in a woman, aged 58 years, who for over a year and a half was thought to have had "spasm of the esophageal muscles," "cardiospasm," "neurasthenia," "major hysteria," finally "mental derangement," because of increasing "globus hystericus" and, later, "refusal" (!) to swallow food, for which she was ultimately placed in a psychopathic institution. She was fed with a stomach tube, the passage of which was thought to rule out organic esophageal disease. After having consulted specialists in various parts of the world she came under the observation of an internist who at once decided the esophagus should be looked at with the esophagoscope. It required thirty seconds to find the lesion, make an esophagoscopic diagnosis of cancer and take a specimen, which Dr. B. L. Crawford found to be a squamous-celled epithelioma. The symptomatic simulation of a neurosis by cancer of the esophagus is very frequently observed by esophagoscopists.

3. Cancer of the thoracic esophagus in a man, aged 26 years, sent in with a diagnosis of "cardiospasm." Form more often than color is the esophagoscopic criterion of malignancy. The anterior (upper) fold is not very different in color from the normal mucosa, but it is granular, almost nodular, with fungations which at a later stage are often quite exuberant. The creases between the folds are filled with oozing blood.

4. Cancerous infiltration of the thoracic esophageal wall in a man, aged 45 years, supposed to have spasmodic stenosis in the middle-third of the esophagus. Here again the color of the mucosa was not far from normal; but the hardness, the rigidity, the absence of the normal characteristics of movement incidental to respiration, pulsation and manipulation described above (1) were deemed so characteristic of malignant infiltration that an esophagoscopic diagnosis of cancer was made. As it was deemed inadvisable to take a specimen at this stage, it was requested that the patient be sent back in six weeks. (See the legend to the following illustration, 5.) An esophagoscopic diagnosis of malignancy was made, however, on the conditions here described, and an immediate gastrostomy was advised, but was postponed.

5. Same patient as in the preceding illustration (4). The anterior rounded ridge of infiltration has ulcerated; a center slough, discolored with bismuth sulphide, is ready to come away. The edges are beginning to fungate, which renders the taking of a specimen perfectly safe. This was done, and Dr. B. L. Crawford reported upon the specimen, squamous-celled epithelioma. The relatively rapid progress of the ulceration was probably due to the constant presence of stagnant, fermenting, irritating food.

6. On the right wall is seen an old scar. This was probably due to the swallowing of lye, twenty years before, of which there was a very clear history. The bleeding fungations at the distal edge of the scar looked so suspicious of malignancy that they were nipped off and sent to the laboratory. Dr. Ernest W. Willets reported upon the specimen as undoubtedly squamous-celled epithelioma.

7. Boy, aged 16 years. Lymphosarcoma involving the anterior wall of the esophagus, at the level of the crossing of the left bronchus. This patient had no difficulty in swallowing. He was supposed to have asthma, causing him to "wheeze and to cough until he vomited." He was referred for bronchoscopy because of the asthmatic symptoms. The bronchoscopic findings shown in the following illustration (8) led to the esophagoscopy. Air bubbles were seen at the depressed necrotic area, and a hissing sound was heard through the esophagoscope when the patient voluntarily coughed at request. Part at least of the dark grayish color of the exudate is due to sulphided bismuth.

8. View down the left main bronchus of the patient referred to in the preceding illustration (7). The bleeding granular mass on the posterior wall of the bronchus evidently was part of the growth visible esophagoscopically (7). What appears like a grayish slough was partially sulphided, swallowed bismuth that came through from the esophagus. Blood was oozing among the fungations.

9. Woman, aged 42 years. Difficulty in swallowing diagnosed cancerous on three previous occasions because of arrest of the bougie, the tip of which came back bloody, and of the history of progressive dysphagia and emaciation. The yellow, globular mass protruding in the ragged, irregular opening was scooped out with the mechanical spoon and found to be cheesy debris and thick pus, with a few giant cells and elements of glandular structure. No tubercle bacilli were found, but Dr. Ernest W. Willets deemed the progress suppurating tuberculosis of the mediastinal glands rupturing into the esophagus. There was no clinical or ray evidence of active pulmonary tuberculosis. Dr. Russell H. Boggs stated that there were slight indications of healed apical lesions. The patient made a good recovery, with normal swallowing, and was above normal weight four years later.

10. Man, aged 47 years. Gastrostomy had been done before admission. This illustration shows a mixed lesion, luetic and cancerous. The large, smooth, rounded mass on the left wall was not very hard and was movable with the tube-mouth. Because of the 4 + Wassermann reaction it was deemed best not to take a specimen. The patient was put upon energetic antiluetic treatment, which resulted in the total disappearance of the dysphagia.

11. The same patient as in the preceding illustration (10); esophagoscopic appearances after two months of energetic antiluetic treatment (KI and Hg prot.). The nodular mass, which was probably a gumma, is seen to have disappeared; but the granular mass has increased in extent and is fungating exuberantly and oozing blood freely. Three endoscopists at the Bronchoscopic Clinic were unanimously of the opinion that the fungating lesion was cancerous. This diagnosis was doubted by the attending physician because of the total disappearance of dysphagia under antiluetic treatment, the gastrostomy tube having been entirely abandoned. A specimen was therefore taken and was reported by Dr. Baxter L. Crawford as squamous-celled epithelioma. The progress of this case confirmed this diagnosis.

12. Peptic ulcer of the esophagus in man, aged 47 years, suffering from dysphagia, odynophagia, severe nocturnal substernal pain extending through to the back. These symptoms, with obstruction to the passage of a bougie which came back bloody, had led to the diagnosis of cancer of the esophagus. The patient was emaciated apparently from pain, sleepless nights and worry in anticipation of a death by cancer, rather than from lack of nourishment. The border of the ulcer was not hard and a small esophagoscope would pass it, going on through the hiatal esophagus into the stomach, which was about eight centimeters below the lower border of the lesion. A specimen removed from the edge of the ulcer showed no evidence of malignancy; only inflammation and ulceration. Histologic elements of gastric mucosa and glandular structure led to the diagnosis of peptic ulcer of the esophagus, starting in an esophageal island of gastric mucosa.

PROGNOSIS

It was stated by the author,⁶ many years ago, that the mortality of malignant disease of the esophagus was, at that time, 100 per cent. Notwithstanding the great advances since made in the surgery of malignancy elsewhere in the body, the ultimate prognosis of esophageal cancer remains the same today. There is every reason to believe, however, that the reason for this is that the surgeons have never had a chance to develop the technique of a curative operation because the diagnosis is never made early. The reason why the diagnosis is never made early is that the textbooks and journal articles give chiefly or exclusively diagnostic methods that *are always negative early* in the disease. When the time comes in which esophagoscopy shall be resorted to promptly on the appearance of certain very vague symptoms there is ample justification for the belief that the surgeon will cure a good percentage of patients. Squamous-celled endoesophageal carcinoma is not an aggressive type of malignancy. On the contrary, it is a mild, slow and for a long time purely local process. Under palliative treatment, if the patient is never permitted to be short of an abundance of water and a full allowance of properly balanced food elements, most cases will survive at least two years from the onset of the disease, and some have survived as long as five years. One lived six years. Patients running the gauntlet of late inferential diagnosis, and leading a precarious existence of various degrees of food and water starvation, depressed and acidotic, on a diet of intermittent supplies of raw eggs and meat broths, may not survive a year from the probable time of the onset of the disease.

TREATMENT

Resection of the Esophagus. Until some now unknown method of treatment of cancer of the esophagus shall have been discovered we must look to the surgeon for hope of cure. Nor should the gravity of the procedure deter us, since we know that the disease involves 100 per cent mortality. There is good reason to believe endoesophageal cancer is curable surgically, at some levels at least, if a sufficiently early diagnosis be made. The fundamental reason for the thousands of agonizing deaths from cancer of the esophagus is false education. The mind of the medical student and the medical profession is so saturated with the

idea that cancer of the esophagus is to be detected by obstruction to the passage of a bougie, in a patient with dysphagia, pain, cachexia and emaciation, that the surgeon never gets a chance to cure esophageal cancer while it is still a local process. When every patient mentioning the slightest abnormality in swallowing, or even slightest abnormal sensation in the cervical, retrosternal or epigastric region, is considered not necessarily neurotic, but possibly cancerous, surgery will show better results. When such a patient shall be referred at once to the roentgenologist for fluoroscopic and roentgenographic study of the esophagus, esophageal cancer will be discovered early and a new era in esophageal surgery will have been established. In most of such cases esophagoscopy should follow the roentgen ray examination, and always in all cases in which the roentgenologist suspects esophageal abnormality. Few surgeons today would wish to expose transthoracically the mediastinal esophagus with a view to resection for cancer without having the esophagoscopist's confirmation of the diagnosis. When a diagnosis can be made by other means it is not only uncertain, but the patient almost invariably has become a bad subject for a major operation. Practically all esophageal resections up to the present time are done upon such cases. It is no wonder the results are so discouraging. They would be so with cancer anywhere in the body.

The foregoing statement of opinion as to the surgical curability of early esophageal cancer is based not on cures, but on some of the findings at the Bronchoscopic Clinic, which may be summarized as follows:

1. Over 90 per cent of all the cases fall into two classes, namely:

- (a) Adenocarcinomata at the lower end of the esophagus.

- (b) Squamous-celled cancer in other locations.

2. This leads to the conclusion that the disease at the lower end of the esophagus started at the cardial margin. If discovered at the start, such cases would offer good chances of cure by exsection through an abdominal incision. We do not refer here to extensive gastric cancer reaching the esophagus very late.

3. The squamous-celled type, which with us has been the most common, means in most

cases an endoesophageal beginning. Here we have a local process of a relatively low degree of malignancy. It is reasonable to expect a good percentage of cures if the surgeon could get the patient in this stage, but he never does, and never will, so long as present obsolete diagnostic methods are taught in the medical schools and promulgated in our journals and textbooks. Our experience abundantly confirms the statement of Willy Meyer¹⁷ when he says:

"There is one important characteristic of cancer of the esophagus that should be especially emphasized, namely, that it is the most benign of all carcinomas of the gastro-intestinal tract. Its growth is comparatively slow; it remains localized for a long time; has little tendency to metastasis in other parts of the body, or in the lymphatic glands, and is not very apt to recur."

Splendid fundamental work in resection of the esophagus has been done by Torek,¹⁸ Miller,¹⁹ Meyer,¹⁷ Janeway and Green,²⁰ Lilienthal,²¹ Muller,²² Hedblom²³ and others. The lacking essential is early diagnosis, which could be furnished by esophagoscopy not only early, but with the absolute certainty essential to getting the consent of a comparatively well man to an operation he may not survive.

Palliative Treatment. The most important palliative measure is very early gastrostomy to stop the mechanical irritation of passing and lodging food and the chemical irritation of fermenting and stagnant food and secretions saturated with oral infections. As Da Costa and Shallow have said, "No surgeon would stretch a cancer." Instead of trying temporary mechanical means to keep the esophagus open, it is better to follow the cardinal rule of surgery to "Let the inoperable cancerous mass alone; put it at rest." The writers who oppose gastrostomy state that it has had, in their hands, a very high operative mortality. These two facts must be taken together. Opposition to gastrostomy means an invariably late operation. Late operations for anything always have a high mortality, but in esophageal cancer late gastrostomy means operation upon a patient moribund from cachexia, inanition, acidosis, and, worst of all, water starvation. Such patients are the worst possible surgical subjects, even for a minor operation. It is no wonder they fail to react. The tissues will not take up water after it is put in the stomach in the worst cases. Up to

this time the case has been a medical one. It is now turned over to the surgeon. No wonder the surgeon joins in condemning gastrostomy. Another reason for discrediting gastrostomy is the mental depression that really comes from acidosis. As previously pointed out,²⁴ gastrostomized patients, unless watched, will drift into a diet exclusively of raw eggs and meat broths. No one could be happy on such a diet even if swallowed normally. Saliva is also necessary. If an early gastrostomy is done and the esophagus put at rest with only water by mouth, saliva will go through for a long time.

Radium is useful in some cases, as shown by Fielding O. Lewis,²⁵ Pancoast, Newcomet, Douglas Quick and others. As pointed out by Quick, overdosage must be carefully avoided.

Roentgen Ray. In our experience, in inoperable cases, patients will live longest under a combination of early gastrostomy, a varied, well balanced diet by tube, plenty of water by mouth and deep roentgen ray treatment. We have seen objective evidence of benefit from the ray in cases treated by Manges, Pancoast Pfahler, Bowen, Cohen, Borzell and others.

CONCLUSIONS

1. It was stated by the author many years ago that the mortality of malignant disease of the esophagus was, at that time, 100 per cent. Notwithstanding the great advances made in the surgery of malignancy elsewhere in the body, the ultimate prognosis of esophageal cancer remains the same today.

2. There is every reason to believe, however, that the reason for this is that the surgeons have never had a chance to develop the technique of a curative operation because the diagnosis is never made early.

3. The reason why the diagnosis is never made early is that the textbooks and journal articles give chiefly or exclusively diagnostic methods that are *always negative early* in the disease.

4. When the time comes in which esophagoscopy shall be resorted to promptly on the appearance of certain very vague symptoms there is ample justification for the belief that the surgeon will cure a good percentage of patients.

5. Squamous-celled endoesophageal carcinoma is not an aggressive type of malignancy. On the contrary, it is a mild, slow

and, for a long time, purely local process.

6. Under palliative treatment, if the patient is never permitted to be short of an abundance of water and a full allowance of properly balanced food elements, most cases will survive at least two years from the onset of the disease, and some have survived as long as five years. One lived six years.

7. Patients running the gauntlet of late inferential diagnosis, and leading a precarious existence of various degrees of food and water starvation, depressed and acidotic, on a diet of intermittent supplies of raw eggs and meat broths, may not survive more than a year from the probable time of the onset of the disease.

8. The bougie as a diagnostic means is not only dangerous, but it is inconclusive because inferential; and it is always hopelessly late. A cancer must be well advanced before it will stop a bougie. Even fatal cancer of the esophagus may not be obstructive.

9. The bougie as a therapeutic measure hastens death either by perforation or by increasing metastases. As stated by Da Costa, "No surgeon would stretch a cancer." As stated by Shallow, "No surgeon would forcibly dilate cancer of the rectum."²⁷

10. There are only two means by which an early diagnosis of esophageal malignancy can be made, namely: (1) Roentgen ray examination, and (2) esophagoscopy. All other means are late, inconclusive, and some of them dangerous.

11. By esophagoscopy endoesophageal cancer can be diagnosed not only early, but with the absolute certainty essential to getting the consent of a comparatively well man to an operation he may not survive.

12. Endoesophageal cancer can be diagnosed just as early, just as quickly and just as certainly as cancer of the cervix if an opportunity for esophagoscopy is afforded early.

BIBLIOGRAPHY

1. Turner, A. Logan: *Carcinoma of the Postcricoid Region and Upper End of the Esophagus*, Jour. Laryngol. and Otol., February, 1920, 35:34.

2. Fraser, J. S.: *Discussion of paper of Dr. Fielding O. Lewis*, Trans. Am. Bronchoscopic Soc., 1923.

3. Gardiner, W. T.: *Personal communication*.

4. Martin, G. Ewart: *Personal communication*.

5. Ewing, James: *Neoplastic Diseases*, 1922, Phila.

6. Jackson, Chevalier: *Peroral Endoscopy and Laryngeal Surgery*, Textbook, 1914.

7. Dean, L. W.: *Coexistent Carcinoma, Tuberculosis and Syphilis of the Esophagus*, Ann. Oto., Rhinol. and Laryngol., September, 1917, 26:619.

8. Patterson, Ellen J.: *Cancer of the Esophagus*, Pennsylvania Med. Jour., 1919, 23:147.

9. Manges, Willis F.: *Personal communication*.

10. Pancoast, Henry K.: *The X Ray Diagnosis of Surgical Disease of the Esophagus*, Surgical Clinics of North America, February, 1924, 4:34.

11. Pfahler, George E.: *The Diagnosis of Esophageal Stricture*, Archives of Diagnosis, January, 1909, p. 2:44.

12. Bowen, David R.: *Personal communication*.

13. Hirsch, I. Seth: *The Roentgen Ray Study of the Esophagus*, Interstate Med. Jour., 1916, 23:4.

14. Jones, J. Arnold: *Some Clinical Observations on the Lingual Tonsil*, Jour. Laryngol. and Otol., September, 1923, 38:465.

15. Tilley, Herbert: *Diseases of the Nose and Throat*, London, 1919.

16. Arrowsmith, Hubert: *Lye Stricture of the Esophagus; Blind Bouginage; Perforation; Death*, New York Med. Jour., June, 1916, 103:1068.

17. Meyer, Willy: *Surgical Diagnosis and Treatment*, Ochsner, Phila., 1921, 2:79.

18. Torek, F.: *The Operative Treatment of Carcinoma of the Esophagus*, Ann. Surg., 1915, 61:387.

19. Miller, Robert T.: *Experimental Surgery of the Thoracic Esophagus*, Bull. Johns Hopkins Hosp., 1923, 34:109.

20. Janeway, Henry H., and Green, N. W.: *Cancer of the Esophagus and Cardia*, Ann. Surg., July, 1910, 52:67.

21. Lilienthal, H.: *Carcinoma of the Thoracic Esophagus; Extrapleural Resection and Plastic Description of an Original Method, With Report of a Successful Case Without Gastrostomy*, Ann. Surg., 1921, 74:259.

22. Muller, George P.: *Archives of Surg.*, January, 1923, January, 1924.
23. Hedblom, Carl A.: *Combined Transpleural and Transperitoneal Resection of the Thoracic Esophagus and the Cardia for Carcinoma*, *Surg., Gynec. and Obst.*, September, 1912, p. 284.
24. Jackson, Chevalier: *Chalk Talk on Gastrostomy*, *Surgical Clinics of North America*, February, 1924, 4:1.
25. Lewis, Fielding O.: *Radium in Cancer of the Esophagus*, *Surgical Clinics of North America*, February, 1924.
26. Wells, H. Gideon: *Errors in Diagnosis*, *Jour. Am. Med. Assn.*, 1923, 35:737.
27. Tucker, Gabriel: *Retrograde Esophagoscopy*, *Surgical Clinics of North America*, 1924, 4:77.
28. Hanford, C. W.: *Radium Technique in Treating Cancer of the Esophagus*, *Jour. Am. Med. Assn.*, January, 1922, 78:9.
29. Coplin, W. M. L.: *Injury, Inflammation, Irritation, Known Causes of Cancer; Their Recognition the Only Safe and Sound Basis of Prevention*, *Jour. Am. Med. Assn.*, May 20, 1922, 78:1523.
30. Jackson, Chevalier: *Tracheobronchoscopy, Esophagoscopy and Gastroscopy*, Phila., 1907.
31. Jackson, Chevalier: *Bronchoscopy and Esophagoscopy*, Phila., 1922.
32. Stewart, W. H.: *Advanced Roentgen Technique in the Diagnosis of Esophageal Lesions*, *Am. Jour. Roentgenol.*, October, 1914.
33. Shallow, Thomas W.: *Gastrostomy, an Improved Technique*, *Surgical Clinics of North*

DEPARTMENT of TECHNIQUE

Roentgenographic Gastro-Colonic Meter*

WM. J. MANNING, M. D.
Washington, D. C.

EMBRACED within the figures or radiographic illustrations here presented which demonstrate or are made to show, in each instance, the utilization of a meter calibrated in inches and half inches (2.5 cm., 1.3 cm.), whose markings are clearly discernible either in the colon and its subdivisions as well as in the oesophagus and respective terminals when radiograms are taken with the meter in position in each specific instance.

The illustration, Fig. 1, shows that meter will accurately measure lesions in the anus, rectum, and pelvic colon. By the method shown, the size of the prostate gland is exhibited in its vertical diameter, as well as fistulae, either complete or incomplete when injected, and in any mass or neoplasm dense enough to cast a shadow along the entire colonic tract. The incomplete fistula shown is found by the calibrations to be one and three-fourths inches from the circular marker at

the anal orifice. The vertical diameter of the prostate is about normal for the age of patient, measuring, approximately, one and one-quarter inches on the anterior surface.

Figure two depicts the meter in position as far as the descending colon at the crest of the ilium. To continue further to the right side of the body would require a meter nearly six feet in length that would extend to the terminal of caecum. It may prove interesting to state at this point, that in the majority of those cases of volvulus due to a stretched mesosigmoid with the attached pelvic colon, all take place usually at the middle or lower third portion of this fractional part of the colonic tract, and are more or less the result of an overloaded bowel distended with feces, aided with and without muscular strain. The sigmoid or pelvic colon drops downward and the partially loosened portion of the mesosigmoid thus permits a twist to occur.

Figure three demonstrates the usual fate of the ordinary "high injection tube" when the

*Received for publication Jan. 15, 1925.

patient is given the so-called "high enema"—safely and snugly coiled in the ampulla of the rectum and far from the colon above—the objective point sought.

In figure four the gastro-colonic meter is seen in the oesophageal tract, and by the measurements and continuity of the meter it is seen to extend from the upper border of the cricoid cartilage opposite the sixth cervical vertebra, thence downward, in normal position, through the oesophageal opening in diaphragm then diverging to the left, opposite the eleventh and twelfth thoracic vertebrae toward the cardiac orifice in which the oesophagus invaginates, and thence along the lesser curvature of the stomach toward the pylorus. In the rubber tube containing an air column, the calibrations are discernible and point to any particular irregularity as shown by the barium meal and will measure any pathological six hour residue in the stomach.

Foreign bodies and neoplasms in the trachea, and the bronchi when conditions will permit, can thus be measured as to distance and size together with foreign bodies in or approximating the vertebral column as low as the last

dorsal vertebrae. Vertical measurements of the heart are most practical and easily made that should result in standardization of this organ. Cavities and calculi of the lungs together with pathological lymph nodes can be noted in a similar manner. The size of aortic aneurisms can also be definitely located and approximated as to size. Various degrees of stomach tonicity can be shown by the angulation of the meter when the cardiac orifice is passed.

Figure five is submitted to show the emergence of the meter from the mouth at the incisor teeth. The length of the photographic plate being only seventeen inches does not permit both terminals of the oesophagus to be shown at the same time. Note should be made of the clearness with which foreign bodies can be shown as to size and location in the pharynx, trachea, and right and left bronchus. In figure 4 a little more time exposure was given to bring out more distinctly the calibrations and numerals through the heavy rubber tubing.

The meter is constructed of twenty-four gauge piano wire to which the metal numerals and wire cross calibrations have been soldered

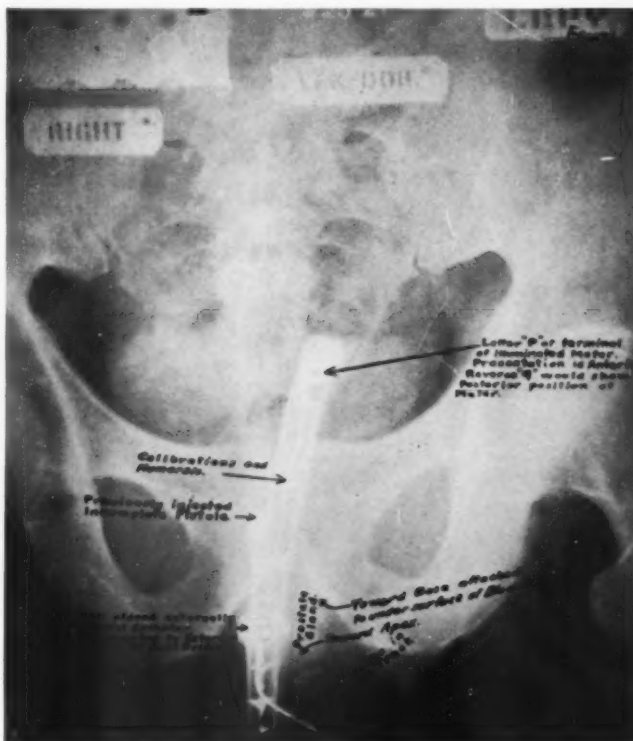


Fig. 1—Gastro-colonic meter in position for measuring prostate gland, together with neoplasms and masses within the rectum and colon. An injected incomplete fistula is also shown that calibrates $1\frac{3}{4}$ inches from anal orifice. Figure is further illustrated above by descriptive markings.

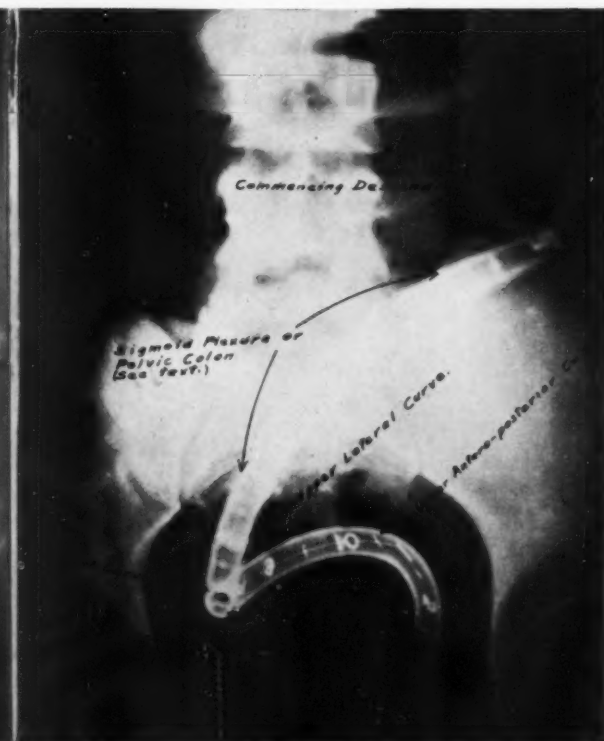


Fig. 2—Exhibiting colonic meter in position as far as the descending colon terminal at crest of ilium. Figure is further illustrated with descriptive markings. Meter is not continued up the descending colon and over splenic flexure to transverse and ascending colon because of shortness of meter in this instance. (See text.)

at one inch and half inch distances and all being entirely covered with a rubber rectal tube of standard size. Observers will please condone those scale imperfections in which the numerals are shown in a distorted manner for in those instances due to numerous resoldering, I was unable to solder the numerals on the wire at the same incident angle or plane as the other numerals, with consequent photographic distortion.

Enough has been demonstrated, however, it is hoped, so that similar calibrations can in the future be stamped out of a straight single strip of metal or other opaque material and a rubber covering be utilized of much thinner

gauge than the thick rubber rectal tube walls. These conditions mentioned should ensure very clear readings as to scale in connection with the x ray and its photographic registrations, and in point of size can be made even as small as the ordinary duodenal tube if required.

My most sincere thanks is due to Dr. William Earle Clark, gastro-enterologist, Dr. Harold E. Dunne, proctologist, and Dr. H. G. Clark, roentgenologist, of this city, for furnishing the writer patients for the exemplified work, from time to time and for many other courtesies.

Medical Science Building.

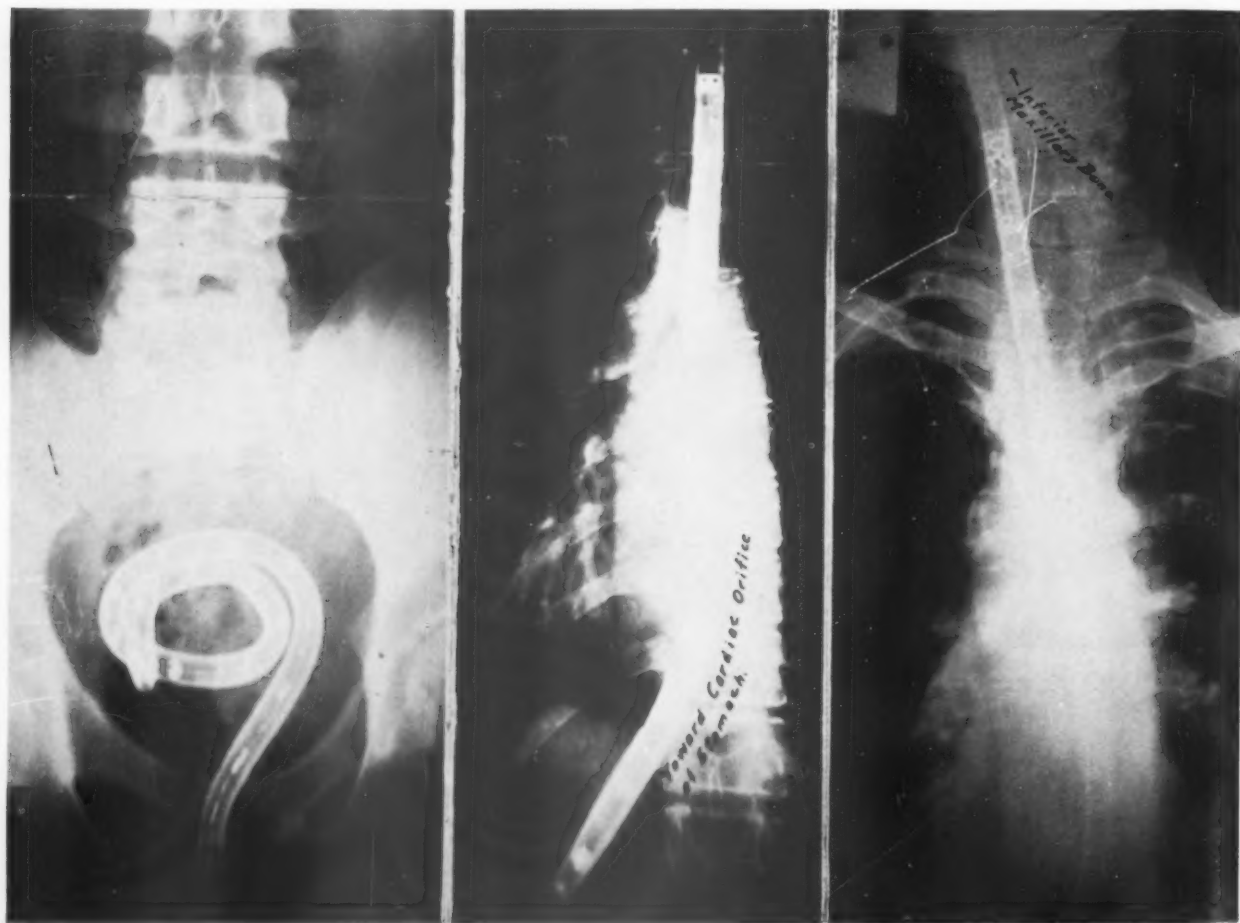


Fig. 3—Showing the "graveyard" of the ordinary "high enema" tube deflected and coiled in the usual resting place—the ampulla of the rectum. It never reaches the objective point of the higher colon.

Fig. 4—Gastro-colonic meter in oesophageal tract. Position of oesophagus is normal. Calibrations are shown reading upward from the lesser curvature of stomach to upper terminal of gullet at the cricoid cartilage nearly opposite 6th cervical vertebra (see text). More

time exposure given this picture in comparison with other figures in order to bring out the markings of the scale through the thick rubber rectal tube.

Fig. 5—Submitted to show the oral terminal of meter emerging through incisor teeth. Note should be made with what clearness opaque foreign bodies in the trachea and bronchi can be measured and located when conditions will permit.

NEW EQUIPMENT

Portable Cardiograph Developed for Recording Heart Actions*

GENERAL ELECTRIC COMPANY,
Schenectady, N. Y.

THE cardiograph itself is not a new device, but never before has there been an instrument which is portable, nor one commercially developed in which vacuum tubes are used for amplifying the heart voltages. This experimental apparatus was demonstrated by L. T. Robinson, director of the general engineering laboratory of the General Electric Company, and H. B. Marvin, also of the laboratory, the two who developed the apparatus.

Records of a patient's heart may be obtained now at the physician's office or in the patient's home. Complete in its case, the apparatus weighs only 37 pounds. In a second box, weighing 33 pounds, the power unit is carried.

In using the old type cardiograph, elaborate protection against vibrations of any kind were necessary; the portable cardiograph operates successfully despite ordinary vibrations. The hospitals which have the old type usually operate them on vibration proof foundations. The portable instrument does not require such methods as placing the hand or foot in a solution, steaming the limbs, putting wet applications under the electrodes, etc. Contacts can be made with simple, metal straps since the functioning of the instrument is not affected by skin resistance.

Whereas previous electrocardiographs were comparatively few in number, and only to be found in large hospitals or in the offices of some few heart specialists, the new instrument is to be available to all physicians and hospitals. A special technician is not required for its operation. With the original apparatus, delicate preparatory adjustments, no longer necessary, were required.

There are many improvements in the portable cardiograph, but perhaps the four most striking are as follows:

1. The electrocardiograph is a complete, portable unit, easily moved about by one man.

2. The character of the records obtained is independent of the patient's skin resistance.

3. The fragile metal quartz thread of the string galvanometer, an important part of the cardiographic apparatus, is eliminated. The quartz thread formerly required is of much less thickness than a human hair, and is fragile and costly. It is so fine that to see it is a problem, and handling it is difficult.

4. In the hands of the physician, no experience or special training is required to successfully operate the portable cardiograph.

The new instrument was recently shipped via express from Schenectady to New York, unpacked, and successfully operated without requiring readjustments, thus demonstrating that its precision is not impaired by handling.

The old type electrocardiograph could be moved only with great difficulty, and shipping it assembled was impossible. A physician can easily learn to operate the portable device after a few demonstrations, and it is expected that the apparatus will be producible at a cost and in quantities which will permit of its wide use throughout the medical profession. It is considered still in the developmental stage, and was shown at the meeting to learn from the physicians if any detailed changes are needed to make the device better suited to their practice.

Contraction of the heart muscles is accompanied or preceded by an electrical manifestation. When a muscle contracts, its electrical potential or voltage differs from that of a muscle at rest. If two points of the body of the patient are connected through a sensitive measuring device, such as a galvanometer, the instrument indicates an electrical tension which varies with the pulsations or beats of the heart.

"What does the curve of the heart voltage tell a doctor?"

It seems to be generally agreed that the proper relationship in the alternating contractions of the auricles and ventricles is maintained by a muscular bundle, sometimes considered as the seat of these electrical im-

pulses. This structure, known as the auriculo-ventricular bundle, is apparently one of the most active groups of muscle fibers in the body. Whenever work is done by any muscle, electrical tension is apparent. With the cardiograph, using selectable connections with the left to the right hand, left hand to left foot, and right hand to left foot, it is possible to obtain a record of the voltage change for each side of the heart, or across the two top chambers or auricles. These curves can be reduced mathematically, and when compared give the length of time required for the heart to contract, i. e., the systole. Any injury or lesion of any kind, or any blocking of any part of the heart causes a change in this rhythmic contraction, which in turn gives a difference in the resulting cardiographic curves.

From experiments and experience, doctors have come to know the significance of various cardiograms, or cardiographic records, for diagnosing different kinds of cardiac pathology.

The voltage difference before and after the heart beat is in the neighborhood of one millivolt, or a one-thousandth of a volt. In the electrocardiograph, the electric pulsation causes a small spot of light to move back and forth over a calibrated ground glass scale for observation, or to traverse a moving photographic film for a permanent record.

The apparatus is mounted in a box measuring 24 inches by 11 inches by 9 inches. When the cover is lifted a panel board is revealed—all of the other parts of the instrument are enclosed beneath this board, out of the way of the operator. In practice, once the set is adjusted, it is necessary only to open the shutter and start the film.

The General Electric Company owes the suggestion of the necessity for the development of a portable, accurate and easily operated cardiograph to Dr. L. H. Newman of Albany, and the late Mr. C. P. Steinmetz.

EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of Ideas and Ideals.

Subscriptions—In the United States, its possessions and Mexico, \$5.00 yearly; Canada, \$5.50; elsewhere, \$6.50 the year.

Advertising rates on application. All advertising must conform to American Medical Association Rules.

Payments for subscriptions and advertising must be made to Radiological Publishing Co., in New York or Chicago Exchange.

Address all communications to Business Office, 511 City National Bank Building.

Published monthly at Omaha, Nebraska, by the Radiological Publishing Company.

A. F. TYLER, M. D.
Managing Editor

American College of Physical Therapy

OFFICERS

John Stanley Coulter, M. D.
Chicago President

Disraeli Kobak, M. D.
Chicago President-elect

J. C. Elsom, M. D.
University of Wisconsin, First Vice President

Frank Walke, M. D.
Shreveport, La. Second Vice President

Arthur E. Joslyn, M. D.
Lynn, Mass. Third Vice President

Fred B. Moor, M. D.
Loma Linda, Calif. Fourth Vice President

Edwin C. Henry, M. D.
Omaha Treasurer

Roy W. Fouts, M. D.
Omaha Secretary

Annual Meeting of The American College of Radiology and Physiotherapy

THE outstanding feature of the annual meeting held at Hotel LaSalle, Chicago, October 19th to 22nd, was the fine spirit of co-operation throughout the sessions. The purpose of all those in attendance seemed to be the scientific study of all physical agents used in medicine, that through the knowledge gained thereby a more intelligent application of the various agents to the treatment of disease might be made.

Dr. Elkin P. Cumberbatch of St. Bartholomew's Hospital, London, was an honored foreign guest who appeared on the program. His clear-cut scientific address on galvanism will appear in the scientific section of the Journal in the near future.

Professor W. T. Bovie of Harvard University presented an illustrated lecture, telling of his research work in the effect of sunlight on growth and development. This lecture was not only of interest to the physician, but to the scientists as well. The work of Dr. Bovie had a double significance, since he is a member of the Council on Physical Therapy recently appointed by the American Medical Association.

Dr. Morris Fishbein, editor of the Journal of the American Medical Association, gave an interesting after dinner speech at the Annual College Dinner. He discussed, briefly, the purposes and aims of the Council on Physical Therapy and told in fascinating style of the various cults which have, from time to time, arisen in America.

Dr. Carl Beck of Chicago spoke of the value of physical agents in medicine.

Dr. Gabriel Tucker of the Chevalier Jackson Clinic, Philadelphia, gave an illustrated lecture on foreign bodies in the air passages, showing especially the valuable help rendered by proper roentgenologic examination when combined with the work of the endoscopist. This paper will also be printed in full in an early number of the Journal.

The College is greatly indebted to Mr. Geo. Hasseltine of the Medical Films, Inc., New York, for one of the most instructive and interesting features of the meeting. At various times during the program he showed the motion pictures made by Dr. Lewis Gregory Cole. One of these showed Gastric Motor Phenomena and another Gastric Ulcers and a third Pulmonary Tuberculosis. One must see these films to fully appreciate their value from an educational standpoint. Everyone present thoroughly enjoyed and appreciated these films.

A report of the annual meeting would be incomplete if we failed to mention the paper by Dr. Rollier of Leysen, Switzerland. In most fascinating style Dr. Rollier described the treatment of Surgical Tuberculosis by Heliotherapy as practiced at his Sanatorium in the Alps. Since Dr. Rollier could not be pres-

ent himself, President Pope read the paper for him and showed the photographs of patients.

Medical Meetings

THE American Roentgen Ray Society recently voted to discontinue sectional meetings, so that hereafter there will be only one meeting each year.

The Radiological Society of North America has also discontinued the summer meeting.

This leaves the following meetings of national scope of interest to radiologists and physical therapists: The American College of Physical Therapy, October, 1926; American Roentgen Ray Society, May, 1926; Radiological Society of North America, December, 1926; American Radium Society, May, 1926, and the American Electrotherapeutic Association, September, 1926.

Cancer Control in Europe

GEORGE A. SOPER, Managing Director of the American Society for the Control of Cancer, has returned to New York after a three months' investigation of the problem of cancer control in Europe. He reports that great interest and activity are being shown in research work into the fundamental causes of cancer and in providing patients with the best means of treatment which the existing state of knowledge permits. Surgery, radium and x rays still afford the main reliance which science and experience have thus far developed for the cure of this disease.

Course in Roentgenology at the University of Minnesota

THE Department of Anatomy allows about fifteen lectures to be given to the freshman class in anatomy on the various phases of roentgen ray anatomy. These lectures comprise an introductory lecture on what a roentgen ray plate means as a record of density, the development of the bony structures, study of the epiphyses, and finally the structure of the adult bones and joints. These lectures are supplemented by typical roentgenograms of the bony skeleton displayed in illuminating boxes in the dissecting room.

In the second year, the students of physiology are required to study with the roentgenoscope the phenomena of respiration, cardiac

*Am. J. Roentgenol., 14:157, August, 1925.

action and digestion. This gives the student a visual idea of some of these important phenomena as they are found in the human body.

In the senior year one hour a week is devoted to general didactic instruction consisting of lectures and quizzes on the general subject of roentgenology. A minimum amount of time is spent on the theory and technique of roentgen examinations. The general purpose of the course is to demonstrate to students the important uses of the roentgen ray and also its limitations. An important part of the subject is the explanation of the necessary preliminary preparation of patients for various examinations. An important feature of the course is also an attempt to demonstrate the difference between satisfactory and unsatisfactory roentgen examinations. This course is compulsory for all senior students and the marks in this course are counted as part of the student's records for graduation.

In the senior year elective courses are offered in plate interpretation, in which the student is given films for study and demonstration. It has been found that while these courses are elective, they have been very largely attended, over half of the classes for the last two years having elected them. A further elective course is given to take up the most rudimentary examinations, allowing the students to make films of some of the important joint structures and to develop the same.

R. G. Allison.

Lewis S. McMurtry, A. B., A. M. D., LL. D.

THE death of Lewis S. McMurtry on February 1 marks the passing of one of the most stalwart, inspired and affectioned members of our medical profession today. His loss will be irreparably felt by his associates and followers at the University of Louisville School of Medicine and by the innumerable diversified exponents of his life teachings.

Lewis S. McMurtry was born in Harrodsburg, Kentucky, on September 14, 1850. He studied at the Centre College, graduating with the A.B. degree in 1870 and three years later received his medical degree from the Tulane University. The A.M. degree was conferred upon him by the Centre College in 1875, and the degree of LL.D. by Tulane University in 1909 and by Centre College in 1922.

He began his active medical practice at Danville, Kentucky, in 1874. He came to Louisville in 1876 and became associated with

medical education. From 1893 to 1908 Dr. McMurtry was Professor of Gynecology at the Hospital College of Medicine, which was later merged into the University of Louisville School of Medicine. He was appointed to the Professorship of Abdominal Surgery and Gynecology of that institution at that time. He became president of the faculty at the same time and retained these positions until he was elected to the Kentucky State Board of Health. At this time he was made President Emeritus and Professor Emeritus of Abdominal Surgery and Gynecology. After holding many judicial positions in the state and county medical associations, he was elected President of the American Medical Association in 1906, serving 1906-7. In 1913 Dr. McMurtry was chosen delegate of the United States to the seventeenth annual Medical Congress in London.

Dr. Lewis McMurtry was an active member of the American Surgical Association, the Southern Surgical Association, the American Gynecological Society and a fellow of the Edinburgh Obstetrical Society.

Dr. Lewis S. McMurtry was a prolific medical leader—his ideals and visions playing a leading role in the development of a balanced and standardized profession. "His was the hand of peace-maker, the mind of the pioneer, the poise of a man who knew men and loved to work with them."

The *Journal of Radiology* is indebted to the *Kentucky Medical Journal* for the biographical facts enumerated.

United States Civil Service Examination

THE United States Civil Service Commission announces the following open competitive examination:

JUNIOR MEDICAL OFFICER
ASSISTANT MEDICAL OFFICER
ASSOCIATE MEDICAL OFFICER
MEDICAL OFFICER
SENIOR MEDICAL OFFICER

Applications for the positions listed above will be rated as received until December 30. The examinations are to fill vacancies in various branches of the Government Service.

For positions in the Departmental Service at Washington, D. C., the entrance salaries are: Junior medical officer, \$1,860 a year; assistant medical officer, \$2,400 a year; associate medical officer, \$3,000 a year; medical

officer, \$3,800 a year, and senior medical officer, \$5,200 a year. Advancement in pay may be made without change in assignment up to \$2,400 a year for junior medical officer, \$3,000 a year for assistant medical officer, \$3,600 a year for associate medical officer, \$5,000 a year for medical officer and \$6,000 a year for senior medical officer.

For positions in the field services appointments may be made at the salaries stated above or at higher or lower salaries, the entrance salary depending upon the qualifications

of the appointee as shown in the examination and the duty to which assigned.

Competitors will not be required to report for examination at any place, but will be rated on their education, training and experience.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the Secretary of the board of U. S. civil service examiners at the post office or custom house in any city.

ABSTRACTS *and* REVIEWS

Gallbladder Disease: A Symposium

ETIOLOGY

Infections of the Gallbladder and Bile Ducts.

E. STARR JUDD, M. D., *J. Lancet*, 45:179-182, April, 1925.

MANY theories have been advanced concerning the function of the gallbladder. Embryologically, the gallbladder arises from a primitive group of cells from which the pancreas, stomach and duodenum originate, independent of the liver anlage. Experiments have shown that when the gallbladder is removed or destroyed definite changes occurred in the extrahepatic biliary system, interpreted as an effort to compensate for the loss of the organ. Small sacculi connected with the intrahepatic ducts have become distended. The older idea that the gallbladder functioned as a reservoir has been rather thoroughly discredited, but the author cannot discard the conception of its function as a tension bulb. One of the other theories concerning the function of the gallbladder is that it has to do with the concentration of the bile. Sweet considers this concentration merely a process in its most important function as an organ of absorption, explaining its anatomical and physiological arrangement which leads him to the conclusion that whatever passes in through the cystic duct never passes out again. He also believes it to have an important function in the metabolism of fats. But, "it is well known," says the author, "that many a person is living just as happily with his gall-

bladder destroyed by disease or removed by operation as he did before, but the mere fact that life can be enjoyed without a gallbladder is not a good reason for removing the organ."

The source of the infection is considered now to enter by way of the blood stream, infecting the tissues and not the bile. Graham has shown by his experimentation on dogs that organisms liberated in the portal vein could be recovered in large quantities, not only from the hepatic tissue, but also from the tissues of the gallbladder.

Acute cholecystitis is a comparatively easily made diagnosis from the clinical history, but chronic cholecystitis is one of the most difficult conditions of the upper abdomen to diagnose. The perfection of the Graham method of visualizing the gallbladder by the roentgen ray should greatly aid in the establishment of these troublesome gallbladder diagnoses.

Etiology, Diagnosis and Treatment of Chronic Cholecystitis. GEO. M. UNDERWOOD, M. D., *Texas State M. J.*, 20:600-604, March, 1925.

THE normal capacity of the gallbladder is about 30 c.c., or about 5 per cent of the average daily output of bile. Its function has been heralded as that of storage, and concentrating the bile. Other experimenters have shown that the gallbladder wall shares with the liver the function of removing bacteria from the blood stream. This function renders it more susceptible to infection. But the wel-

fare of the gallbladder is also dependent upon the character of the bile. The character of the bile is dependent upon the health of each liver cell, and the liver cell must depend upon its blood supply from the hepatic artery and be influenced by the portal veins. The portal system drains the gastrointestinal tract. It is from this reasoning only natural that one should expect a relation between gastrointestinal infection and gallbladder disease. Rose now has shown the affinity of organisms for the stomach, duodenum and gallbladder. Graham has also shown the relation or association of gallbladder infection to hepatitis and pancreatitis.

To briefly enumerate the causes of gallbladder infection: (1) focal infection; (2) abnormal conditions of the blood stream; (3) impaired health of hepatic cell; (4) hypercholesterolemia, as in syphilis, diabetes, post-typhoid, etc.; (5) jaundice, and (6) biliary stasis.

In making the diagnosis, the history is important. Supplementing the history, the physical examination will often reveal characteristic localized findings. Gallbladder drainage is also considered as a necessary link in the diagnostic chain. Urinalysis and stool analysis may reveal bile. The x ray examination will help to exclude gastric ulcer, cancer, syphilis and benign tumors of the stomach. Also, indirect evidence may be obtained, such as pylorospasm or cadiospasm; deformity due to pressure or adhesions of the duodenum in which duodenal ulcer is not demonstrated. No mention is made of the visualization method of Graham.

"The treatment of chronic cholecystitis is never all medical nor all surgical; it must not be forgotten that chronic cholecystitis is mainly featured by infection and calculi formation."

BACTERIOLOGY AND HISTOLOGY

One Hundred Consecutive Cholecystectomies.

WILLIAM O. JOHNSON, M. D., *Am. J. Med. Sci.*, 170:181-185, August, 1925.

ORGANISMS were cultured from the fluid contents of pathological gallbladders in less than one-third of the cases on this series. *B. Coli* was the predominating organism. The highest percentage of positive cultures was obtained from the gallbladders which contained the lowest percentage of bile salts.

Histological changes seem to indicate that the lesions in the appendix are of longer duration than the other associated gallbladder lesions. Histologically, pathological gallbladders with culturable organisms in their fluid content have a far higher mucus content than normal gallbladders. The walls show an increase in fat content and thickening.

PATHOLOGY

Gallbladder Pathology and Deductions Therefrom. WILLIAM SINGER, M. D., *Colorado Med.*, 22:237-240, July, 1925.

BASING his classification upon the numerous gallbladders personally examined, with a careful correlation with the clinical history and postoperative follow-up, the author divides pathological gallbladders into eight groups. In the first group he places the normal appearing gallbladder (uniform thickness, blue slate color, no stones or adhesions), but with lymphatics along the cystic and common ducts enlarged. Microscopic examination of these show lymphocytic infiltration. If left alone, the clinical symptoms will recur until removed. In the second class is placed the normal appearing gallbladder with a few adhesions, without evidence of other abdominal disease. In the third class, normal appearing gallbladders with "innocent stones" are considered. Localized hepatitis, more or less definitely surrounding the adjacent gallbladder, is considered an individual condition. In group five, acute cholecystitis with or without stones is discussed. During the active process, the phenomenon of inflammation with bacterial invasion predominates. Group six includes only the acute gangrene of the gallbladder. The perforated gallbladder requires a separate classification. Tumors of the gallbladder, papillomas, adenomas benign or malignant growths are included in group eight. In each pathological condition it is the opinion of the author that operation is indicated sooner or later, depending upon the condition presented.

DIAGNOSIS

Cholecystography: Oral Administration of Sodium Tetraiodophenolphthalein. EVARTS A. GRAHAM, M. D.; WARREN H. COLE, M. D.; SHERWOOD MOORE, M. D., and GLOVER H. COPPER, M. D., *J. A. M. A.*, 85:953-955, Sept. 26, 1925.

OF the total of 467 hospital and ambulatory patients in whom cholecystography has been performed, a correct diagnosis has been

made in 95 per cent of the cases confirmed by operation. No mortalities have been reported, due to the intravenous injection of the dye. In about 13 per cent of the ambulatory cases receiving intravenous injections, slight nausea and vomiting symptoms have resulted.

Successful cholecystograms can be made by oral administration of sodium tetraiodophenolphthalein and sodium tetrabromphenolphthalein. The merits of the oral administration as compared to those of intravenous injection cannot be given. Considering the amount of the material reaching the liver as one of the important features in diagnosing the function of the gallbladder as well as a means of visualizing the organ, oral administration is indefinite.

The dose of sodium iodophenolphthalein by mouth is about 0.07 gm. per kilogram body weight, an average adult dose being 5 gram. This may be given in phenyl salicylate coated pills or capsules, containing 1 gram of the dye. The five capsules or pills are taken in the course of the evening meal near 6:30 p. m. Nothing is taken by mouth until after films have been taken at 9 a. m. and 1 p. m. the following day. The evening meal can be eaten as usual. The technique is the same for the roentgen ray exposure as is used for other cholecystograms. In the 112 cases in whom cholecystography was performed after oral administration of the dye, only 4 per cent of these patients were nauseated and vomited. The symptoms were for the most part negligible.

The accuracy of oral administration cannot usually equal that of intravenous injection. The method used by the authors for gallbladder examination is first an attempt to determine the function of the gallbladder by oral administration. If a shadow of the gallbladder is not produced and if there is a question of radiologic technique or any other factor, as vomiting, which makes the result doubtful, the findings are confirmed by intravenous injection.

Satisfactory cholecystograms have been obtained by the use of the somewhat analogous compound, phenoltetraiodophthalein, which is the eleventh substance that the writers have produced which are capable of producing cholecystograms.

The Oral Administration of Sodium Tetraiodophenolphthalein for Cholecystography.

LESTER R. WHITAKER, M. D.; GIBBS MULLIKEN, M. D., and EDWARD C. VOGT, M. D., Surg. Gynec. & Obst., 40:847-851, June, 1925.

THE oral administration of sodium tetraiodophenolphthalein is being used in the Surgical Clinic and Department of Roentgenology at the Peter Bent Brigham Hospital, Boston, for cholecystography in the form of pills coated with salol in syrup of Tolu.

Cholecystograms have been produced in 93 per cent of normal subjects by this method. They advise the use of the oral method first in cases suspected of gallbladder disease, to be followed by the intravenous method in the few instances in which the result with the former is not conclusive.

The advantages of the oral method are that it relieves many patients of the hospitalization necessary for the intravenous method, and that it causes them very little inconvenience and few unpleasant symptoms.

Cholecystography by Oral Administration of Soluble Radiopaque Salts. CARL S. OAKMAN, A. M., M. D., Am. J. Roentgenol., 14:105-109, August, 1925.

THE tetraiodophenolphthalein is better than the tetrabromphenolphthalein salt, since it gives equal results by smaller dosage, only five grams per 20 pounds body weight being necessary in the former, while five capsules, each containing 15 grams, are used in the latter. Patients are directed to take a dose of compound licorice powder before noon meal preceding the day of examination. The evening meal should be light, avoiding excessive fats. The salol coated pills or capsules were given one immediately before the evening meal, one during the meal, one immediately after the meal and the others at half-hour intervals after. The patient was directed to drink water freely during the evening meal and to take one or two ten grain doses of soda bicarbonate to neutralize the acid in the stomach so the capsules won't disintegrate and to stimulate the sphincter of Oddi, preventing evacuation of the gallbladder. The following morning the patient reports for examination at 8:30 without breakfast.

The oral method of administration introduces elements of doubt in diagnosis, as compared with the intravenous method, because of the personal equation of the patient, the pharmaceutical quality of the medication and

the physiological variations in the gastrointestinal tract. Further experience will reduce these elements materially.

The oral method has the advantage of being more susceptible of general use than the intravenous method.

Until the dye method is perfected it is advisable, whenever possible, to take gallbladder detail films without the dye as well as with it, and to follow through the usual opaque meal examination. It is possible that the old methods will never be entirely eliminated, but will always need to be used in doubtful cases.

Patients need to be cautioned as to the necessity of following directions, and at the time of examination a careful interrogatory is required to verify this point. A story of vomiting must be detailed with exactness.

Administration of the dye is probably contraindicated in cases of pyloric obstruction, hyperemesis, common duct obstruction and advanced cirrhosis of the liver.

The method should enable us to state positively in many cases that no gallbladder disease exists, and this alone is a big step in advance. In the past, rarely have the physicians been able to rule out cholecystic pathology.

In the opinion of the writer, this method should eventually lift the ratio of accurate diagnosis to about 90 per cent in the hands of competent roentgenologists, and increase the absolute number of cases that can be definitely diagnosed.

Further Experience With the Tetrabromphenolphthalein Sodium Salt in the Roentgenographic Diagnosis of Gallbladder Disease.

WILLIAM H. STEWART, M. D., *Am. J. Roentgenol.*, 13:259-265, March, 1925.

THE purpose of this communication is to express the value of tetrabromphenolphthalein injections and to enumerate the dangers that may be expected from its use.

To prevent deterioration, the tetrabromphenolphthalein is put up in 5.5 gram ampules. This is the dose administered each case. The content of the ampule is dissolved in 40 c.c. of freshly distilled water heated over a water bath for fifteen minutes, or it may be boiled over a flame. After the careful preparation of this solution, it is administered intravenously in two doses, 20 c.c. at first and then repeated in one-half hour. The medical man

giving the injection should be skilled in the administration of salvarsan.

In many of the cases, even though the greatest of care is taken, reactions are observed. The first sign is a flushing of the face, followed by headache, nausea, vomiting and faintness. The severe symptoms last but a few minutes, but there may be a persistent headache and dizziness for about twenty-four hours.

A more careful selection of the patients has resulted in a diminishing of these toxic symptoms. No patient having a cardiac lesion should be subjected to this procedure. Diabetics and those suffering from severe constitutional diseases cannot be considered as good risks. Highly emotional and neurotic patients do not take kindly to the test, almost always showing grave symptoms.

It was also learned that patients who had been on a starvation diet previous to the injection did not react so severely, so this was embodied in the preparation for injection. In addition to a thorough cleansing of the intestinal tract, the patient was given practically no food the day before the test was made. Some milk at noon and water in quantities during the day, with an evening meal of pure vegetable soup, was all that was allowed. The following morning at 8 a. m., a hypodermic of 15 minims of 1/1000 solution of adrenalin was administered, the intravenous injections to begin at 8:30 and 9:00 a. m. If there was much flushing after the administration of the first dose, 5 minims more of adrenalin was given hypodermically just before the second dose.

The precautions that are to be observed in the administration intravenously of salvarsan should be observed with this drug. Great care should particularly be taken that freshly distilled water be used and not some that was in the laboratory. It is also very necessary that all instruments be sterile.

The needle should be inserted first, before connecting the syringe and the solution injected *slowly*. This is best accomplished by having the patient lie in a recumbent position, and great care should be taken in withdrawing the needle so that not a single drop of the solution be dispensed into the tissues, for a very severe reaction and probably a localized slough will result. But with all these observations on the toxic effects, one must admit that of the thousand or more cases injected not a single death has been reported.

After the intravenous injection of the drug, the patient is left in peace for four hours. During this time confidence should be instilled into the patient, by the explanation of the purpose of the roentgen examination. He should be carefully instructed to suspend respiration at full inspiration so that the gallbladder will be brought down to the lowest level. Explain to them that time will be given for all the requirements before the exposure is taken.

The roentgenographic technique for gallbladder examination is variable. The author uses a Bucky-Potter diaphragm with firm compression, a small cone at a 28 inch distance, a gas tube taking 35 ma., a 4 inch back-up and an exposure in an average individual of about three seconds. Double screens and films are used.

The maximum roentgenographic shadow of the normal gallbladder is about four to eight hours after injection. The first screening is made at this time. Repeated examinations are made eight, twelve and twenty-four hours following the injection. At least six films are made at each visit. The shadow largest at four to five hours gradually lessens in size, but becomes more distinct from the seventh to eighth hour. The shadow then gradually diminishes in size and distinctness, disappearing entirely about thirty hours after injection.

The indications for using this method of visualizing the gallbladder may be summarized "when ordinary methods of roentgen examination have been exhausted without obtaining the information desired, then and only then are we justified in using the 'Graham test.'"

Cholecystography, After the Method of Graham, Cole and Copher. SHERWOOD MOORE, M. D., *Am. J. Roentgenol.*, 13:515-527, June, 1925.

THE most reliable roentgenographic indication of a pathological gallbladder, namely, stones, is a most uncertain method of estimating disease of that organ. In the roentgenologic diagnosis based on the demonstration of stones, a thickened gallbladder or the secondary signs of a pathological gallbladder in the hands of the writer has proven only 34.7 per cent correct. These figures, taken with the known high incidence of diseases of the gallbladder, show the uncertainty of result

of roentgen examination and makes most welcome to the roentgen worker a more accurate method of study of the biliary tract. Cholecystography, as far as it has been used in the author's laboratory, seems to bridge the gap left by the older method of examination and supplies a more precise knowledge of the diseased gallbladder.

In order that the gallbladder may be visualized by this injection method, it is necessary, as has been pointed out by Graham, Cole and Copher, (1) that the liver excrete the dye; (2) that the hepatic, cystic and common ducts be patent; (3) that the gallbladder have the ability of emptying and filling itself; (4) that the latter, once filled, be of a size to contain a sufficient amount of dye to give rise to a shadow; and (5) that the gallbladder be able to concentrate the dye.

If these conditions are fulfilled a cholecystogram should be produced. Failure to obtain such a shadow has indicated disease of the biliary tract. Proved pathological cases have presented no shadow or lack of intensity with constancy of size. Gradations in intensity should be appraised with care, especially those that border on the density approximating the normal shadow. In the article the author presents numerous radiograms to illustrate the interpretation. Of a series of 53 cases operated then, 5 were interpreted as normal and found to be so at operation; 2, normal at operation, gave no shadow; 46 were believed to be pathological and 44 were positively confirmed, giving a percentage of 92.5 correct.

Several dyes have been employed for the visualization of the biliary tract, the most uniformly satisfactory being the sodium salt of tetrabromphenolphthalein, until the later preparations of the tetraiodophenolphthalein produced cholecystograms of a better reality. "This dye, in our hands, has been successfully given only by the intravenous method, though it has been administered by mouth and rectum."

The dose of the salt given is, in the case of tetrabromphenolphthalein, 4.5 to 5 grams for the patients weighing above 120 pounds, and for the tetraiodophenolphthalein salt, 3 gram doses is satisfactory. The directions laid down by Graham, Cole and Copher in the *Ann. Surg.*, 1924, 80:473-477, are quoted in full and advised by the author to be followed most exactly:

"Technique: Injection of the sodium salt is very easily done with a syringe; preferably in two doses one-half hour apart. We have not given it all in one dose and do not know if any deleterious results would follow. Much better results are obtained if the injection is made in the morning between 7:30 and 9:30 a. m., before breakfast.

"If Mallineckrodt's crystalline sodium salt is used, the solution is prepared by adding about 40 c.c. distilled water to five and one-half grams of the sodium salt. It is ready for injection after filtration and sterilization. If the patient weighs less than 120 pounds, the dose should be reduced accordingly; great care must be exercised not to allow extravasation of the solution into the tissues of the arm. To avoid this possibility the needle should be first inserted into the vein before the syringe containing the material is attached. After completing the injection, it is well to run a little saline solution through the needle.

"Orders for the patient:

1. Omit breakfast.
2. Omit lunch (may have a glass of milk).
3. Lie on right side of abdomen or be up walking around.
4. Omit proteins after evening meal.
5. May have water by mouth.
6. Sodium carbonate, grs. xL, every three hours for forty-eight hours.

"Roentgenograms are taken at four, eight, twenty-four and thirty-two hours."

Although cholecystography promises so much, the author considers no indications that it will supplant present methods of roentgen examination of this field. "Instead of simplifying procedures, it has complicated them by introducing another step that has to be used if the best work is to be done. This added complexity is, however, offset by the value of the findings so brought out."

This is exemplified by the fact that under the most favorable circumstances and with meticulous care the usual roentgenographic methods of examination of the biliary tract by the writer have been but 73.4 per cent correct over an eight year period when checked by operation. In the relatively short interval of time that visualization of the biliary tract by the injection method has been used, "cholecystography has been 92.5 per cent efficient in our hands."

Gallbladder Visualization (Graham Test). E. A. BAUMGARTNER, Ph.D., M. D., and C. HARVEY JEWETT, M. D., Clifton M. J. Bull., 2:1-5, March, 1925.

THE authors report a series of nineteen cases, presenting in tabular form the presence or absence of jaundice, colic and chronic indigestion, the kind of dye given, the amount and fluid, the reaction obtained from each injection, the positive or negative x ray findings, the subsequent history, and final diagnosis.

As a result of these cases, no definite opinion is expressed concerning the value of this dye in the diagnosis of gallbladder conditions. "We feel, however, that the test will prove of definite value."

Cholecystography and the Diagnosis of Chronic Gallbladder Disease. KENELO WINSLOW, M. D., and C. MELGARD, M. D., Northwest Med., 24:124-128, March, 1925.

THE symptoms of gallbladder disease are vague and varied. The most frequent are gas, belching and distention. Pain is of most varied description, ignoring the right-sided pain, which may even simulate pleurisy. This may be aggravated by large meals, fatty or acid foods. A conjunctival icteric tinge is suggestive. Tenderness is the most important sign, but may even be confused with duodenal ulcer.

In considering such a history, the chief condition from which cholecystitis must be differentiated is duodenal ulcer. No clean cut history can often be obtained. The gastric analysis may be of some acid, for anacidity, normal acid and hyperacidity is reported by some to exist equally, although the authors consider achylia as the rule. Another possibility is the presence of a kidney lesion. The very presence of a chronic appendicitis speaks for the possibility of subsequent or associated gallbladder disease.

"Therefore, I would lay down and stress the dictum that the gallbladder should always be removed during abdominal exploration, when after competent study a diagnosis of chronic cholecystitis has been made, and when no other lesion is found by the surgeon to discredit this diagnosis (chronic cholecystitis), and that this rule shall apply even when the gallbladder appears perfectly sound—to the surgeon.... Some exceptions must of course be taken. In liver and pancreatic infections with jaundice,

drainage through the gallbladder is usually indicated, and removal of the viscus is postponed until a later date....A routine removal of the appendix is also in order....I have had many regrets at the non-removal of gallbladders by surgeons and have yet to suffer the humiliation of having a truly normal gallbladder removed."

With the development of the dye injection method of Graham and Cole, new hopes developed for the diagnosis of gallbladder disease. The technique is outlined by the authors. The interpretation of the plates is essential. The shadow of the gallbladder is oval or pear-shaped and should be uniform in outline, homogeneous in density, and varies in size with the filling and emptying of the dye. Abnormalities are shown by a faint or wholly absent shadow, by delay in filling or emptying, by deformities in contour, by unvarying size and by mottling of the shadow. The absence of the shadow is of the chief importance. The less you see the more it means in skiagrams of the gallbladder with dye, the reverse of ordinary x ray diagnosis. Failure of the dye to fill the viscus may be due to tumors, adhesions or stones, or the presence of inspissated bile. Mottling of the shadow of the gallbladder may be caused by stones, papilloma or pressure of the bowel. Failure of the liver function in cirrhosis or hepatitis is theoretically possible, so preventing filling of the gallbladder by the dye. But the liver shadow would also be absent.

In the opinion of the authors, the diagnostic value of the dye bids fair to rival the use of the x ray in gastro-intestinal patients. "Graham and Cole claim to make a correct diagnosis of cholecystitis, even in recent lesions, in 95 per cent of cases."

TREATMENT

Gallbladder Disease: 'Ostomy and 'Ectomy.
RUSSELL S. FOWLER, M. D., F. A. C. S., Am.
J. Surgery, 39:163-164, July, 1925.

THE treatment of gallbladder disease always resolves itself to surgery. The type of surgery that should be used may be generalized: cholecystectomy in severe, acute inflammation; cholecystectomy in mild, acute and chronic inflammation. Hard and fast conclusions cannot be drawn without due consideration of the relation between the lesion present at the original operation and the final result. But if the process advances, duct and pancreatic in-

volvement may complicate the gallbladder and liver pathology.

Surgical Procedure in Jaundiced Patients. E.
STARR JUDD, M. D., J. A. M. A., 85:88-92,
July 11, 1925.

A PRACTICAL application of the work of McNee, van de Bergh, Aschoff and Mann to the surgical treatment of jaundiced patients. The most valuable aid in the handling of jaundiced patients is the van de Bergh test for the quantity and quality of the bile in the serum.

Much has been accomplished in the preoperative treatment of jaundiced patients, which means more than the intravenous administration of calcium. The author believes that in the deeply jaundiced patients the common ducts should always be drained with a tube, and the gallbladder should be drained if necessary, but not removed.

Hepaticoduodenostomy is the procedure of choice in cases of postoperative stricture. Cholecystogastrostomy offers considerable relief in certain types of inoperable malignant diseases, and also seems helpful in cases of hepatic infectious jaundice.

Multiple needle punctures in cases in which the liver is badly damaged allow a certain amount of blood and fluid to drain out, and may tend to restore the function of the liver.

Hepatic pathology may accompany or follow gallbladder disease. With the existence of gallbladder disease there is always a certain degree of associated hepatic pathology. It is, therefore, essential to diagnose gallbladder disease and remove the focus before the hepatic pathology becomes definite.

After the establishment of hepatic pathology a variation is made in the usual treatment.

Diathermy in Biliary Affections. DISRAELI KOB-
BAK, M. D., Clin. Med., 32:521-524, August,
1925.

AFTER reviewing the physiology of the liver, the function of diathermy and its application to ascites, the author discusses its relation to icterus.

"Chief amongst the factors that influence jaundice are the various irritants or toxins that produce inflammatory swelling of the terminal portions of the common bile duct. Osler recognizes Murchison's classification, which is (1) obstruction by foreign bodies within

the ducts, as gall stones and parasites; (2) inflammatory tumefaction of the duodenum, or of the lining membrane of the duct; (3) by stricture or obliteration of the duct; (4) by tumor closing the orifice of the duct or growing in its interior; (5) by pressure on the duct from growths of the stomach, liver, pancreas, kidney or omentum.

"Here, bipolar diathermia is a valuable adjunct. It must be given sedatively at first and with a fairly low amperage. Because of the absorptive qualities of diathermia, the sudden and rapid elimination of cholic toxins and bile into the general circulation often produces symptoms of intoxication. Furthermore, the diathermized liver and gallbladder do not need the high amperage of their comparatively dense structures.

"It has been our experience that relatively low heat with bipolar diathermia is a valuable adjunct in the first three classifications enumerated by Murchison. The last two, dealing with neoplastic obstruction, fall clearly within the realm of surgery. We have found that sedative therapy must be observed in order to obtain both immediate and lasting results."

CUTANEOUS SYSTEM

The Limitations of Radium Therapy in Dermatology. LAURENCE R. TAUSSIG, M. D., Am. J. Roentgenol., 14:121-130, August, 1925.

THE author carefully considers the various dermatological conditions in which radium is used as a therapeutic measure and presents his reasons for the indications or contra-indications for its use in each pathological condition.

For ringworm, radium has been used, but he advises roentgen therapy. Another criticism is made of the use of radium for the removal of superfluous hair—the atrophy and telangiectasia. Electrolysis is advocated.

There are a large group of birthmarks and benign growths of various different types that are classified as nevi and in nearly every one of them radium has been used more or less successfully. These various types are discussed by the writer.

The practitioner of radium therapy is frequently called upon to treat warts. There are many kinds. With verruca vulgaris, the author suggests curettment or cautery rather than radium, the same being true with ver-

rucae planae, or the flat warts usually found on the face. The plantar warts, occurring on the soles of the feet, are often mistaken for painful callosities. After peeling the callous off completely roentgen or radium may be applied. Occasionally a radioresistant wart is found. After three repeated treatments, with six week intervals, there is no change for the better, curettment and cautery are advised. Senile or seborrheic warts should not be treated by radium.

Leucoplakia often develops from chronic irritation. After removal of the cause radium may be applied, but if improvement is not immediate, electrodesiccation or cautery should be used.

Keratosis have a tendency to undergo malignant degeneration. In these cases, it has been repeatedly pointed out by Pfahler and others that radium is definitely contra-indicated.

Synovial cysts respond very well but slowly to moderately screened radium exposures.

Lupus erythematosus is due to a toxin. The treatment advocated by the author is first, to remove the cause, then try phenol or ichthyol ointment, etc., reserving radium for the more resistant types.

Lupus vulgaris is better treated by radium than any other agent.

Keloids are often treated by radium, but are perhaps more economically treated by the roentgen ray.

Chronic skin diseases, as chronic eczema, psoriasis and the lichens, have been definitely checked by roentgen therapy.

In the treatment of the large group of malignant growths of the skin, lip and buccal cavity, the judicious use of radium has proven one of the big advances in modern therapy. Basal cell epithelioma are the most common of the skin malignancies and, fortunately, are the ones which respond best to radium therapy. For the squamous epithelioma there are diverse opinions. Some advocate surgical rather than radiological, but radium therapy in combination with other methods is certainly of value in preventing recurrence. Carcinoma of the lip is always of the squamous cell type, so is still among the debatable.

Buccal carcinoma present a difficult problem. They are to be differentiated from lues

This may be done with difficulty. If the lesion history, etc., tends toward a syphilitic infection, a Wassermann may help. Yet one may have a syphilitic infection, not demonstrable grossly, but evidenced by the Wassermann, and at the same time possess carcinoma. If the therapeutic test will not materially aid, a section should be taken for diagnosis. All carcinomata of the mouth, including the tongue, tonsils, pharynx, palate and cheeks, should be treated with radium, either alone or in conjunction with the actual cautery, or with electrocoagulation.

Sarcoma of the skin are best treated with a combination of radium therapy, with radical surgery or electrodesiccation. In the treatment of melanoma, the lesion should be destroyed as completely as possible with the actual cautery and treated with radium.

Erfolge der Strahlenbehandlung des Hautkrebses. W. F. WASSINK, M. D., and C. PH. WASSINK-VAN RAAMSDONK, M. D., *Acta Radiologica*, 4:146-156, May, 1925.

THE final results of 160 cases of skin cancer, treated by radiation during the period 1914 to 1922, with a period of observation of from three to ten years, are given. All the cases could be followed up, nearly all of the surviving patients were examined by the authors personally. Most of the patients received radium treatment only, a few of them were given x ray treatment only, while others were given radium alone or in conjunction with x ray after excochleation.

The census taken on January, 1925, demonstrated 102 patients, or 63.7 per cent, alive and free from recurrences. Up to the time of this review, from one to eight years after treatment, 28 had died without recurrences or metastases. Therefore, if we include these 28 cases in this series, the treatment should be considered successful in 130 cases, or 81.25 per cent.

Recurrences during the first period of one to eight years were seen in 25 patients, or 15.5 per cent, all of which, with one exception, could be cured by radium.

In the 44 cases, a previous attempt at radical cure by one or more operations, radiation treatment, caustics or some of these methods combined, had failed, before the patients were seen by the authors. Twenty-seven cures could still be maintained among this group. Of the 116 cases not treated previously elsewhere, 104,

or 89 per cent, could be cured. Eight patients out of the 116 should be either considered as lost causes from the beginning or died so soon that results could not be expected. In four out of the 108 other cases, the treatment was a failure. Here, as well as in the other unsuccessful cases mentioned above, this was due to unexpected extension of the tumor or to the impossibility of sufficient radium application, or to the appearance of secondary growths. There was not a single case where the authors were obliged to fall back upon surgical treatment.

GASTRO-INTESTINAL SYSTEM

Pharyngo-Esophageal Diverticula. PORTER P. VINSON, M. D., J. A. M. A., 85:178-180, July 18, 1925.

DIAGNOSIS of an esophageal diverticula can usually be made by a careful consideration of the history and physical examination. Roentgenographically, the size of such a diverticulum can readily be ascertained. The passage of a blunt olive over a silk thread is absolute confirmation of this sacculation.

In differential diagnosis, all diseases producing obstruction high in the esophagus must be considered. These for the most part can be ruled out by a roentgenographic examination, with a consideration of the historical facts and the physical examination.

Diverticulum of the Stomach. IRVING GRAY, M. D., *Am. J. Roentgenol.*, 14:110-113, August, 1925.

THE author reports a case who recently came under his observation and who in the course of a routine gastro-intestinal examination demonstrated a peculiar condition.

Diverticula of the stomach may be either congenital or acquired and are diagnosed only by roentgen examination. There is no definite clinical symptom-complex that is characteristic of this condition. It is well to bear in mind, however, that this condition does occur and may either be associated with symptoms for which other organs are held responsible, or may be purely an accidental finding, as is illustrated by the case here reported.

X Ray in the Diagnosis of Duodenal Ulcer. L. P. HOLMES, M. D., J. M. A. Georgia, 14:368-370, September, 1925.

X RAY has become a very essential laboratory measure in the diagnosis of gastric or duodenal ulcer. Its value is more

marked in the duodenal ulcer where the pathology is more readily and definitely visualized.

To summarize the roentgen signs of duodenal ulcer, the author classifies them as follows:

1. Direct signs, under which falls the actual deformity of the duodenal contour.

2. Indirect signs, under which is reclassified:

- (a) Alterations of gastric tone.
- (b) Alterations of gastric peristalsis.
- (c) Alterations of gastric motility.
- (d) Gastric spasm.
- (e) Tenderness localized to the duodenum or below and to the right of the umbilicus.

In the diagnosis of duodenal ulcer, roentgenology holds the most important place over all other present methods.

Chronic Diarrhoea. WELLS TEAVHNOB, SR., M. D., F. A. C. S., Ohio State M. J., 21:315-320, May, 1925.

CHRONIC diarrhoea is not a disease. It is only a symptoms—the treatment and prognosis of which rests upon the physician carefully considering the various etiological factors and determining the cause in each specific case. An examination of the bowel contents in any disorder causing chronic diarrhoea is as essential as the examination of the urine in nephritis. An x ray examination as an aid to an early diagnosis is of comparatively little value—whether the source be cancer, tuberculosis, parasitic infestation, syphilis, simple ulcerative proctitis or sigmoiditis.

A diagnosis can be made by digital and instrumental examination, together with a scientific stool examination, long before the x ray will show any changes in the bowel other than position. After the pathological changes have progressed far enough to produce gross defects, the x ray is then of value—but a diagnosis should always be made before this stage is reached.

BOOKS RECEIVED

Operative Gynecology. Third Edition. By *Harry Sturgeon Crossen*, M. D., F. A. C. S., Professor of Clinical Gynecology, Washington University Medical School, and Gynecologist in Chief to the Barnes Hospital and to the Washington University Dispensary; Gynecol-

ogist to St. Luke's Hospital; Consulting Gynecologist to the Jewish Hospital, St. John's Hospital and the St. Louis Maternity Hospital; Fellow of the American Gynecological Society and the American Association of Obstetricians, Gynecologists and Abdominal Surgeons. Cloth. Price, \$12.50. Pp., 677, with 887 original illustrations. St. Louis: C. V. Mosby Company, 1925.

Gynecology for Nurses. By *M. J. Seifert*, A. B., M. D., F. A. C. S., Attending Surgeon and Gynecologist, Columbus Hospital, Chicago; Consulting Surgeon, St. Mary of Nazareth Hospital, Chicago; formerly Professor of Physical Diagnosis and Anesthesiology, University of Illinois; Adjunct Professor of Operative Surgery, University of Illinois, etc. Cloth. Pp., 325, with 115 illustrations. New York: D. Appleton & Company, 1925.

Department of Labour—British Columbia—Annual Report for the year ending December 31st, 1924. Printed by authority of the Legislative Assembly. Charles F. Banfield, Printer to the King's Most Excellent Majesty, Victoria, B. C., 1925.

Clinical Features of Heart Disease. An Interpretation of the Mechanics of Diagnosis for Practitioners. By *Leroy Crummer*, M. D., Professor of Medicine, University of Nebraska. Introduction by *Emanuel Libman*, M. D., Physician to Mount Sinai Hospital; Professor of Clinical Medicine, Columbia University, New York. Cloth. Price, \$3.00. Pp., 353. New York: Paul B. Hoeber, Inc., 1925.

Ocular Therapeutics. A Manual for the Student and the Practitioner. By *Ernst Franke*, M. D., A. O. Professor of Ophthalmology and Chief of the Second Eye Clinic at the University of Hamburg. Translated by *Clarence Loeb*, A. M., M. D., Oculist to the Michael Reese Hospital and Head of the Department of Ophthalmology of the Michael Reese Dispensary, Chicago, Ill. Cloth. Price, \$3.50. Pp., 183. St. Louis: C. V. Mosby Company, 1925.

Pediatrics for Nurses. By *John C. Baldwin*, M. D., Lecturer in Pediatrics, Johns Hopkins Hospital School for Nurses; Pediatrician in Charge Florence Crittenton Mission Nursery; Pediatrician Babies' Milk Fund Association. Cloth. Pp., 261, with 25 figures and illustrations. New York: D. Appleton & Company, 1924.

New and Nonofficial Remedies—1925. Council on Pharmacy and Chemistry of the American Medical Association. Pp., 461, mentioning over 1,500 drugs or their derivatives. Chicago: American Medical Association, 1925.

Physiotherapy. Theory and Clinical Application. By *Harry Eaton Stewart*, M. D., President-elect American Academy Physiotherapy; Attending Specialist in Physiotherapy, U. S. Marine Hospitals, N. Y.; Director New Haven School of Physiotherapy; Formerly Assistant Director Section of Physiotherapy, Office of the Surgeon General, U. S. Army and Supervisor of Physiotherapy, Bureau of U. S. Public Health Service, Washington. Price, \$7.50. Pp., 351, with 66 illustrations. New York: Paul B. Hoeber, Inc., 1925.

Hand Book of Therapy. Seventh Edition Revised. By *Oliver T. Osborne*, M. D., Professor of Therapeutics, Yale University Medical School, and *Morris Fishbein*, M. D., Assistant to the Editor, Journal American Medical Association. Pp., 720. Chicago: American Medical Association, 1923.

BOOK REVIEWS

Pathology and Bacteriology of the Eye. By *E. Treacher Collins*, F. R. C. S., Consulting Surgeon to the Royal London Ophthalmic Hospital and Consulting Ophthalmic Surgeon to the Charing Cross Hospital, etc., and *M. Stephen Mayou*, F. R. C. S., Surgeon to the Central London Ophthalmic Hospital, etc. Cloth. Price, \$10.00. Pp., 731, with 4 colored plates and 306 figures in text. Philadelphia: P. Blakiston's Son & Co., 1012 Walnut Street, 1925.

The frequent method of handling such a subject is to consider the various affections from an anatomical basis, but in this treatise the authors have classified the diseases of the eye on a physiological basis—dividing them into the several processes which occur in the life history of the organism.

Such a classification considers the life cycle of the organism—consisting of the process of evolution or development to a state of maturity, which is reached and maintained by absorption of nutrient material, and is influenced by environmental conditions, finally undergoing the process of involution or degeneration.

In the first chapter, *aberrations in development* include the various derivations from normal which occur in the eye in its process of evolution.

In this process of development some of the tissues may retain or reassume some of their embryonic characteristics. This atavism of tissue, or teleplasm, may arise from the various embryonal structures. These teleplasms, together with metastatic growths and cysts, are discussed in the second chapter under *neoplasms*.

The development of the eye depends upon the nutrition. The derangements in the circulating fluids, from the blood vessels, lymphatic spaces and intraocular chambers are considered in a third chapter, *disturbances in the circulation and constitution of the nutrient fluids of the eye*.

Disturbances resulting from environmental influences are considered under three separate headings. Chapter four treats with mechanical, chemical, thermal, electrical and radial injuries. The reaction of the tissues to irritation, or inflammation, is discussed in chapter five. *Parasitic diseases affecting the eye* and the specific reactions which they produce are reviewed in the sixth chapter.

The conditions resulting from degeneration or involution of the various tissues of the organ are described in the last chapter.

At the end of the text an appendix treats with the different laboratory methods which are employed in the pathological examination of the tissues of the eye, and the staining and recognition of the numerous bacteria associated with these changes.

The completeness and exactness of the text stamps it as one of the most if not the most complete monographic discussion on the pathology and bacteriology of the eye.

Electro-Therapy and Ionic Medication. A technical and clinical compendium expressly written to meet the needs of general practice. By *Harold H. U. Cross*, Ph.D. (Med.), formerly Research Worker at the Stanford University, California. Cloth. Price, \$4.50. Pp., 253, with 155 illustrations. Philadelphia: J. B. Lippincott Company, 1925.

In the words of the writer, the aim of this text is to supply just such technical information as will show the student and the practitioner the underlying electrical and chemical principles of the subject, in order that an intelligent interest may be taken in the selection and use of the various forms of apparatus and

methods of treatment now so generally available.

The consideration of the fundamental principles of electricity in the first two chapters is designed to present to the physicians who have not previously acquired any electrical education a sufficient acquaintance with electromagnetic laws as to enable the practitioner to intelligently understand the physical indications presented.

After establishing a working knowledge of these electrical principles typical apparatus is described, stressing the various electrical and chemical points presented.

The therapeutic consideration begins with a discussion of magnetism and electricity and their simpler applications to medicine. Under the principles and practice of electrolysis, theory, chemistry, treatment, technique and precautions are elaborated. Special attention is, however, given the subject of ionic medication, which appears as the outcome of many years' work in the field both in the clinic and laboratory. After discussing the high frequency current, emphasizing their indications, application and treatment, another chapter is especially devoted to roentgen ray notes, considering the historical aspect and describing in detail the various types of apparatus used. At the end of the work a special chapter is devoted to the electrical treatment of cancer.

For the general practitioner who desires an essential knowledge of the fundamental principles of electrotherapeutics and an understanding of the workings of the numerous types of apparatus used, and for the radiologist whose theoretical teaching has been negligent or who wishes a clear understanding of the principles of the modern apparatus in use, this text is especially valuable.

Conduction and Infiltration Anesthesia.

By Mendel Nevin, D. D. S., Oral Surgeon Greenpoint Hospital, etc. Cloth. Price, \$5.00. Pp., 313, with 190 engravings. Brooklyn: Dental Items of Interest Publishing Co., 1923.

The question of anesthesia is of extreme importance to all students of surgery. This text is particularly outlined to aid the dental surgeon, attention being directed exclusively to the anesthetization of the head and neck supplied by the branches of the cranial nerves.

After reviewing the *birth of anesthesia*, the important anatomical structures and land-

marks in conduction anesthesia are outlined with reference to the oral cavity. To the dental surgeon, anesthesia of the *trifacial nerve* is of utmost importance. The author elaborately illustrates its ramifications and propounds the methods of block. In a separate chapter the *blocking of the superior maxillary nerve* and its branches, the second division of the trigeminal, is more thoroughly discussed and illustrated. Dissections, showing the anatomical relations of these nerves and the course of the needle when making the injections, are of tremendous value. Under *pterygomandibular anesthesia*, the technique for mandibular injections, lingual anesthesia, inferior dental, long buccal and mental injections are described and demonstrated. In cases of wounds, accidents, ankylosis, swellings, etc., where entrance through the mouth is impossible, *extraoral injections* are essential. One must know the anatomical landmarks and visualize the structures lying beneath.

Local anesthesia may be subdivided into four groups: infiltration, or peripheral; conduction or nerve blocking; intra-arterial, and intravenous. In his consideration of *infiltration anesthesia*, the author includes the methods of production, the indications of each method and the technique of application. The *pharmacology of the drugs used in local anesthesia*, the *vehicle used for local anesthetics*, the *preparation of the anesthetic solution*, and the *patient* is knowledge essential for the anesthesiologist and postoperative treatment of the patient. It is always best to anticipate the *postinjection and postoperative sequelae* and instigate measures for their obviation. Much has been said of the *relative toxicity of local anesthetics*. In a few pages devoted to this question many important observations are made.

It does not minimize the mastery of the author nor detract from his superior ability when one notes that the outstanding feature of this text, that which above all others makes it a necessary part of the armamentarium of the student of anesthesia, is the wonderful dissections and photos illustrating the various methods recommended. For in these vivid plates, through the admirable cooperation of author and publisher, anatomy, physiology and pathology are indelibly imprinted upon the memory of the reader. Coupled with the clear, concise style of the writer, the details of con-

duction and infiltration anesthesia, applicable to dental surgery, are adequately elaborated for the education of the student of dentistry.

Goiter: Nonsurgical Types and Treatment. By *Israel Bram*, M. D., Instructor Clinical Medicine Jefferson Medical College. Cloth. Price, \$6.50. Pp., 479, with 152 illustrations. New York: Macmillan Co., 1924.

In the preface of this text, the author reasons that all goiters do not need surgical intervention since: (1) Goiter is preventable; (2) all early goiters are curable; (3) thyroidectomy results in a failure in a large percentage of surgical cases; and (4) a large percentage of goiters surgically treated are amenable to nonoperative procedures. It is the object of this volume, therefore, to stimulate interest in nonsurgical aspects of goiter and to clarify the vision of the surgeon and internist on this problem—not to promulgate new nonoperative managements, but to focus and emphasize the known facts.

After an essential consideration of the *Anatomy and Physiology* of the thyroid gland, the *Diagnosis and Classification* of goiter is discussed.

The therapeutic classification of thyroid enlargements presented by the writer contains only two types: (1) Nonsurgical, including simple parenchymatous hypertrophy, colloid goiter, puberty hyperplasia and exophthalmic goiter; (2) Surgical, embracing adenomatous, cystic and all other types of thyroid enlargement. With the exception of strumitis, malignant goiter and diffuse adenomatosis, surgical goiters are encapsulated while nonsurgical goiter is unencapsulated. So long as a thyroid swelling is encapsulated, reasons the author, it implies a physiological necessity for more thyroid hormone elsewhere in the economy, or it indicates a defensive reaction against toxins during the existence of a focal or general infection. Encapsulation, on the other hand, is an indication that physiological adaptation has ended and a pathological reaction has begun. In other words, as a general rule unencapsulation, a physiological unbalance, is amenable to medical measures and encapsulation, a pathological condition, is a surgical condition.

Endemic Simple Goiter and *Simple Nonsurgical Goiter* are presented separately. These simple parenchymatous and colloid goiters do not as a rule demonstrate constitutional symptoms, unless occasional evidences of mild hypo-

thyroidism or pressure symptoms.

Puberty Hyperplasia may be of either the mild or severe type—the local and constitutional symptoms varying accordingly.

The major portion of the monograph is devoted to the discussion of the hyperplastic thyroid swelling of Graves' disease or *Exophthalmic Goiter*. Exophthalmic goiter is a complicated condition—a variable chain of symptoms depending upon the degree of dysfunction of the various members of the endocrine system and vegetative nervous system. Only removal of exciting causes, coupled with rest, diet, drugs and other measures as psychotherapy, can hope to facilitate the restoration of this emotional and endocrine balance. How can thyroidectomy, asks the writer, a measure calculated merely to overcome thyroid hypersecretion, cure a disease so complex and widespread?

The author has long been recognized as an authority on the medical management of goiters. Years of intensive study on diseases of the thyroid enables him to present such a monograph with precision. This book, containing a wealth of information and clinical judgment, is deserving of serious consideration and study by all practitioners of medicine.

Practical Medical Series, 1924. Under the general editorial charge of *Charles L. Mix*, A. M., M. D., Vol. IV Pediatrics, Edited by *Isaac A. Abt*, M. D., Professor Pediatrics, Northwestern University Medical School, with collaboration of *Johanna Heumann*, M. D. Price, \$2.00. Pp., 381, with 25 plates and illustrations. Vol. V Gynecology, Edited by *Thomas J. Watkins*, M. D., F. A. C. S.; Obstetrics, Edited by *Joseph B. DeLee*, A. M., M. D. Price \$2.00. Pp., 534, with 41 illustrations. Chicago: Year Book Publishers, 1924.

The same careful consideration of the current medical literature of 1923, chosen for review in the previous volumes, and the thorough manner in which their contents was presented to the readers, persists in the volumes under observation.

The simplicity and preciseness that has characterized the other texts reviewed is further exemplified by the remaining volumes of the 1924 series.

For one who wishes to keep abreast of the yearly advances made in the several specialties that go to make up that one great unified science, this series will prove of distinct value.

Bring Your Problems to Physiotherapy Headquarters

Fischer's Type "G" Portable



Type "G"

A real complete-service equipment designed to deliver the popular modalities in an efficient manner at the bedside, or operating table-plenty of power and range-accurate control - perfect insulation - all necessary refinements-neat in appearance-and truly portable - weight about 50 lbs.

Also furnished mounted on handsome walnut hospital cart with rubber-tired castors and ample drawer space for electrodes, etc.

Write for catalog and prices.

H. G. FISCHER & CO., Inc.

Physiotherapy Headquarters

2333-43 Wabansia Avenue

CHICAGO



